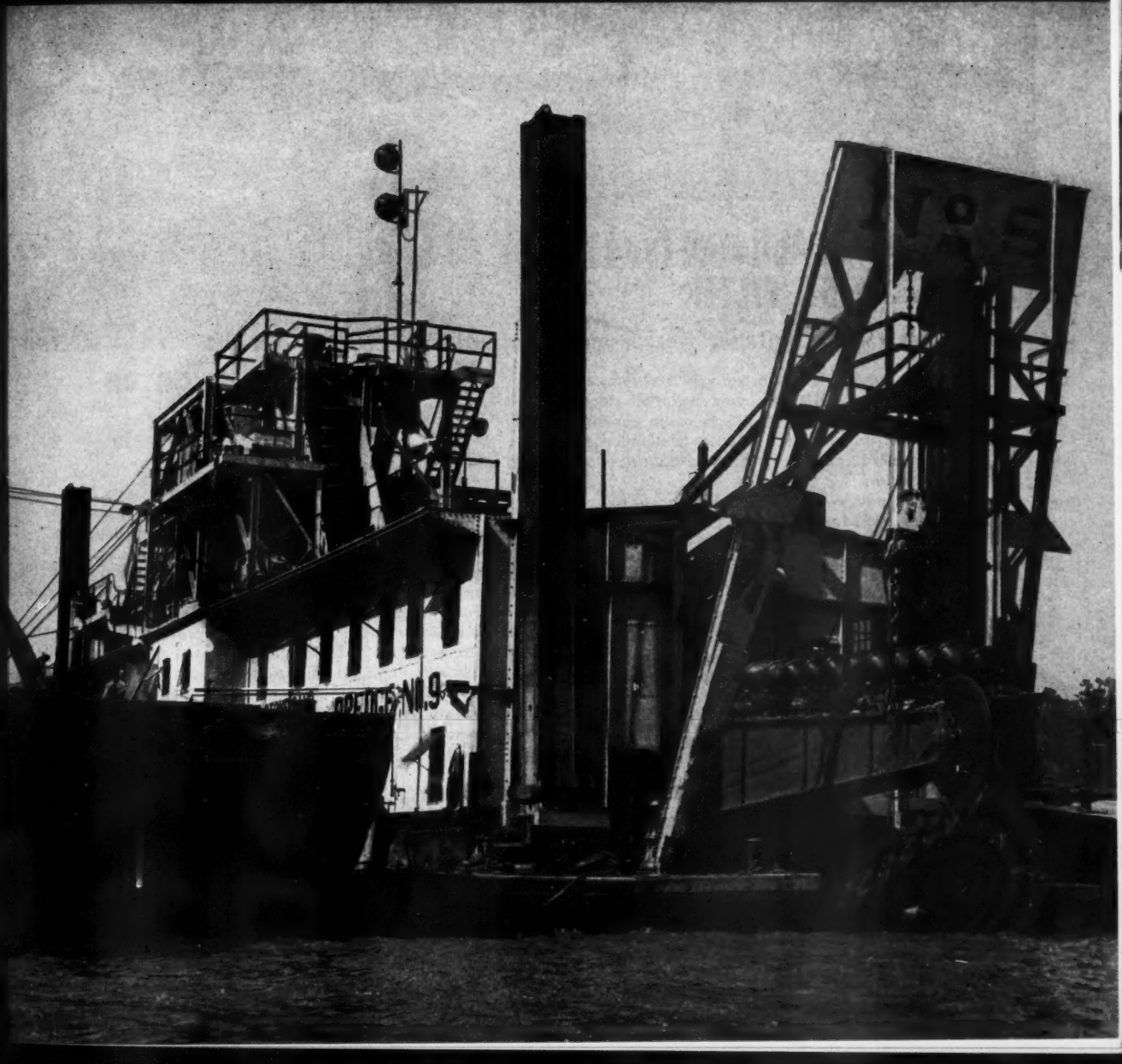
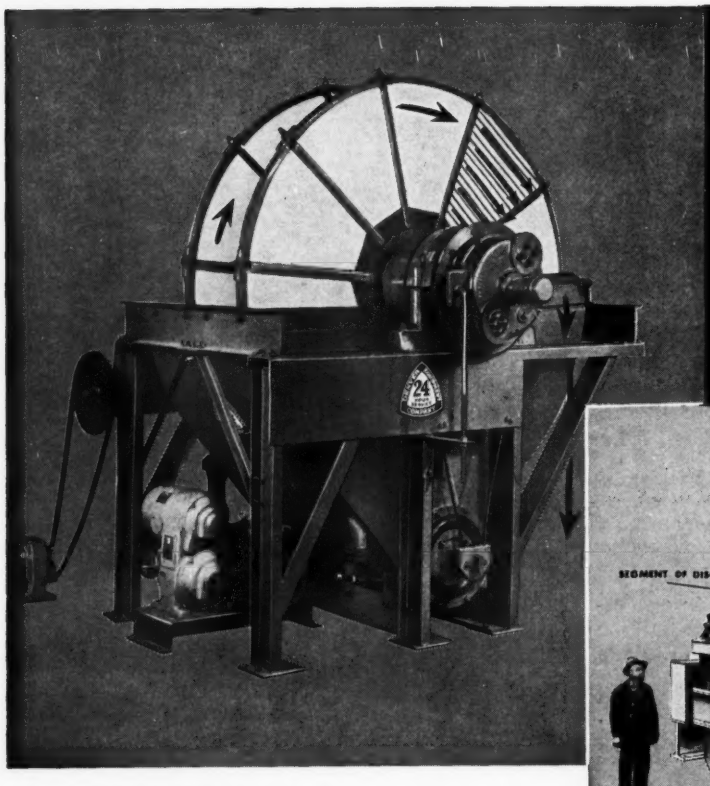
Mining CONGRESS JOURNAL

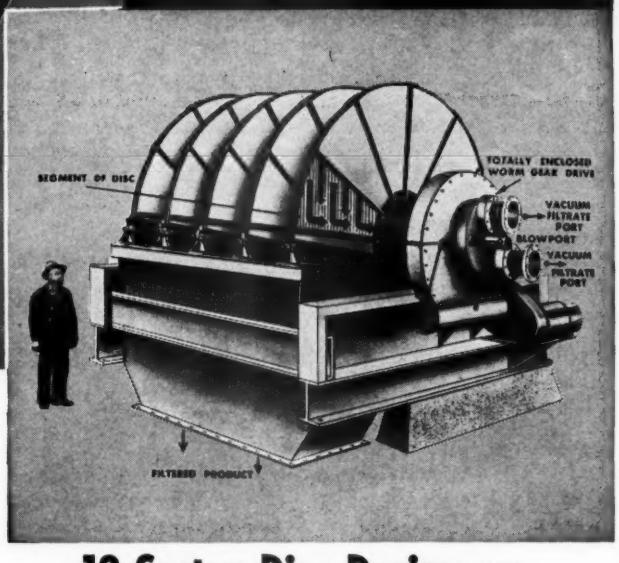
AMC





NEW!

NEW!



DENVER Agitator-Type DISC FILTER

Has New, Simple Agitating Mechanisms

...offers increased filtration capacity and reduced moisture content—PLUS a simple agitation mechanism. NO PACKING GLANDS to cause expense and delays. Proper tank agitation is supplied to keep solids in suspension for even cake distribution of filter sectors.

NEW, patented DENVER agitation mechanism eliminates need for submerged bearings, packing glands or sealing water. Contamination from grease or sealing water is completely eliminated. Maintenance is minimum. Agitating mechanism can be removed easily as unit. Write for bulletin F9-B5.

ROBERT E. HANCOCK, DECO Sales Engineer, is a graduate Metallurgical Engineer with many years of valuable experience. He will be glad to work with you on any filtering problem and send you recommendations based on sound engineering.

12-Sector Disc Design on 9′ DENVER Filter

Means EXTRA Filter Capacity

There are 12 sectors per disc on the 9′ DENVER Disc Filter as compared to only 10 sectors normally used. Vacuum is effective through greater portion of filter cycle. It is applied sooner after cake discharge and retained longer before cake discharge.

Patented gravity drainage grooves in filter sector remove residual moisture by gravity and prevent blow-back of moisture before cake discharge giving drier product. Available with Patented Tank Agitator.

Every Engineer planning a new filter installation will want to study the design, specifications and distinctive features of DENVER filters. Bulletin F9-B4 will be sent on request.

"The firm that makes its friends happier, healthier and wealthier"

DECO ENGINEER

DENVER EQUIPMENT 24 HOUR SERVICE COMPANY

DENVER EQUIPMENT CO.

1400 Seventeenth St. • Denver 17, Colorado

DENVER • NEW YORK • CHICAGO • VANCOUVER • TORONTO

MEXICO, D. F. • LONDON • JOHANNESBURG

Mining

CONGRESS JOURNAL

NOVEMBER, 1957

VOLUME 43 NUMBER 11

CONTENTS

FRONT COVER shows a bucket ladder dredge used by the Dravo Corp. for production of sand and gravel from Ohio River deposits. In an article beginning on page 68, W. L. Price describes several beneficiation processes utilized by the sand and gravel industry—the largest single mining industry in the country from the standpoint of tonnage produced.

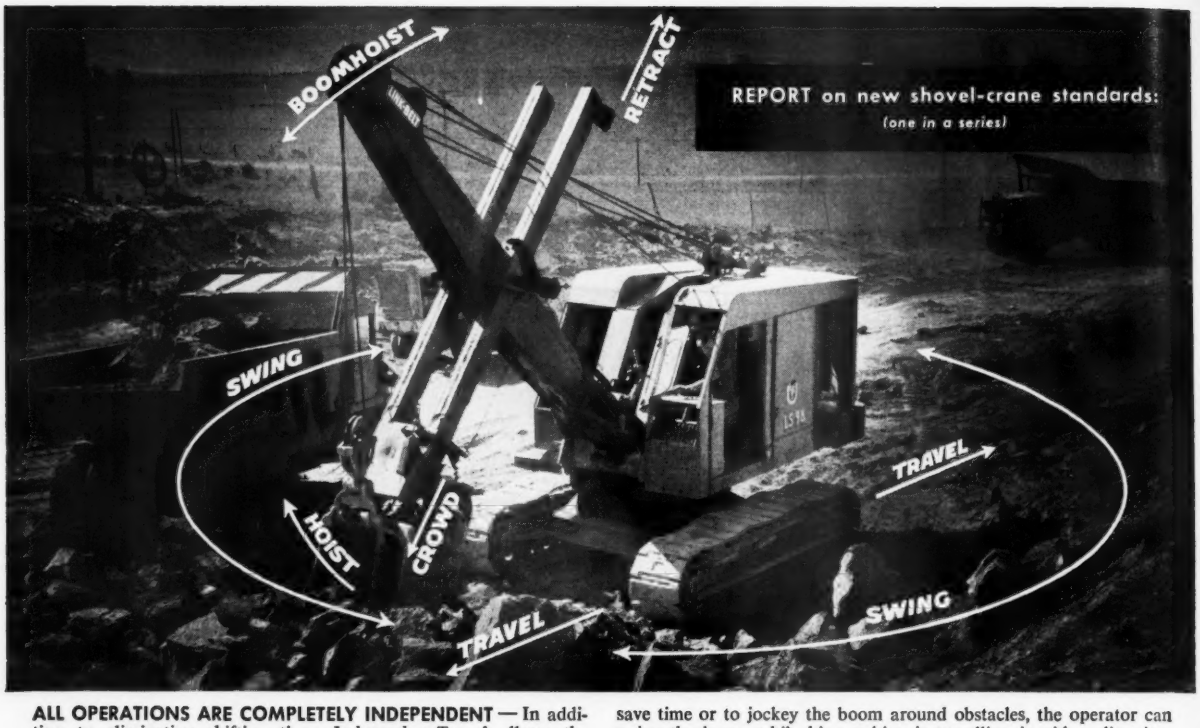
ARTICLES

DEPARTMENTS

Published Monthly. Yearly subscriptions, United States, Canada, Central and South America, $3.00. Foreign, $5.00. Single copies, $0.30. February Annual Review Issue, $1.25. Entered as Second-class Matter, January 30, 1915, at the Post Office at Washington, D. C.

Member Audit Bureau of Circulation

Indexed regularly by Engineering Index, Inc.



ALL OPERATIONS ARE COMPLETELY INDEPENDENT — In addition to eliminating shifting time, *Independent-Travel* allows the operator to swing and hoist the load while travelling. Whether to save time or to jockey the boom around obstacles, the operator can swing the boom while his machine is travelling in either direction. This optional feature can be used with any front-end attachment.

Getting 9 hours' output in 8

Independent-Swing-and-Travel is available on 11 Link-Belt Speeder models. Eliminates shifting . . . saves 20-30 seconds each move

Link-Belt Speeder users are setting new high-production standards by equipping their machines with *Independent-Swing-and-Travel*. Why? It eliminates time losses ordinarily occurring when the operator shifts from swing to travel and from travel to swing. With *Independent-Travel* shifts are eliminated and the machine can swing and travel simultaneously . . . you can jockey the boom around obstacles in tight quarters, move away from bank cave-ins in split seconds!

If you'd like complete details, proof that *Independent-Travel* can up output . . . cut maintenance and spare parts costs, too — see your Link-Belt Speeder distributor or write Link-Belt Speeder Corporation, Cedar Rapids, Iowa.

MORE USABLE HORSEPOWER — Size for size, Link-Belt Speeder shovel-cranes utilize more of the engines' available horsepower. This bonus pays off in added power at the bucket teeth, greater line pull plus extra power to swing, hoist and travel. Although it gets more usable power and line pull out of the same engines used in other shovel-cranes, a Link-Belt Speeder remains well within the engine manufacturers' recommended operating speeds.

14,324

It's time to compare . . . with

LINK-BELT SPEEDER

Builders of a complete line of shovel-cranes . . . with exclusive Speed-o-Matic power hydraulic controls

how to have friends—even though blasting

There's a new, effective way to aid your public relations in communities where you are blasting. It's the interesting, informative sound film, in color, entitled, "*We're Blasting Near You.*"

When you show this film to PTA meetings, service clubs and other civic organizations, you can prove that you're a good neighbor . . . that blasting, while necessary, is nothing for people to be alarmed about.

"*We're Blasting Near You*" shows how modern millisecond delay techniques eliminate old-fashioned, jarring explosions . . . how modern methods hold blasting noise to a muffled minimum, and make vibration unnoticeable. In a friendly, noncommercial way, the movie shows your efforts to be a good citizen in the community.

You can show this movie to any age group. It is accompanied by a kit containing news releases, sample speeches, safety posters and other helpful material which will make your public relations meeting a success. Write for available dates, and show "*We're Blasting Near You*" in your community!

Technical Customer Service Section

ATLAS POWDER COMPANY

WILMINGTON 99, DELAWARE

offices in principal cities

New! JOY HARD ROCK LOADER

- Air or Electric
- Forged Rollers, Shoes, Links
- Independently-controlled crawlers
- Built to individual specifications

The all-new Joy JSL-7 Shovel Loader is designed and built specifically for the really rough hard rock jobs. This crawler-mounted brute has been beefed up with forged parts at all the tough impact points; has three interchangeable Pistonair® motors in the air version—(255 ft. lb. stall torque motors in the electric)—and delivers a 12,080 lb. crowding effort at the bucket lip.

Joy JSL-7 Loader	Specs
Height, minimum	60"
Headroom Range.....	79" to114"
Width, overall	57½"
w/platform	68"
Length, bucket in digging position.....	112½"
Weight, Air.....	9,650 lbs.
Electric	11,250 lbs.
Loading, average.....	2—4 tpm

Independent Crawler Control

Each crawler, independently powered by a famous Joy 15 hp Pistonair motor, is reversible . . . the Joy JSL-7 can turn in its own length. No need for run-backs and repositioning when this Shovel Loader swings into action!

Control Positioning Optional

Standard positioning of controls on left side of Loader as pictured. Right-side mounted or dual mounted controls are also available in either air or electric models. "Deadman" controls flip to neutral when released.

Joy Builds to your Requirements

In addition to standard specifications tabulated at left, the Joy JSL-7 Shovel Loader is available with special buckets, arms and counter weights for mucking on grades greater than 9° uphill or 15° downhill. Arrangements for bucket discharge heights to 87" are available.

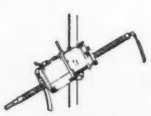
Call in the Joy Engineer and tell him what you want the JSL-7 to do for you. Ask him about the choices of bucket design and capacity, grousers, 'dozer attachments and other available extra equipment. Write to *Joy Manufacturing Company, Oliver Building, Pittsburgh 22, Pa.* In Canada *Joy Manufacturing Company (Limited), Galt, Ontario.*

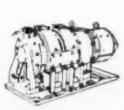
WRITE FOR FREE BULLETIN 203-3

Write for this new bulletin covering the Joy JSL-7 Shovel Loader. 8 Pages of dimensions, weights and drawings.

WSW M6860-203

JOY . . . EQUIPMENT FOR MINING . . . FOR ALL INDUSTRY


Core Drills


Slushers


Rock Bits


Drillmobiles

◀Big rocks are moved easily and fast by 210 hp Tournatractor. When this job is done, fast-stepping tractor will highball to next shovel, traveling across or along tracks with no damage.

Roads and rails wind along steep, winding benches. Tournatractor's speed, and easy maneuverability are big time-savers in moving job-to-job. ▼

rubber-tired tractors end rail, crawler damage ...speed pit clean-up

At a major southwestern copper mine, four speedy 210 hp LeTourneau-Westinghouse Tournatractors® have solved a serious rail and crawler damage problem — and are paying their owners other substantial performance dividends.

The problem: ore blasting often buries sections of the more than 50 miles of railroad track in the pit. When crawler-type tractors had the job of dozing away debris, they regularly damaged ties, rails, and their own crawler tracks. Today, rubber-tired Tournatractors handle this assignment with *no* damage. Their wide, low-pressure tires flex harmlessly while rolling over track installations... never throw rails out of alignment... never block switches, or chamfer ties.

Faster shovel-to-shovel travel

Superintendents at the mine report that, in addition to solving this problem, Tournatractors have demonstrated two other important work assets: faster job-to-job travel speed, and unusual ability to work economically in rocky material.

Speed on travel between assignments is particularly important on this operation, because major task of Tournatractors is cleaning up around shovels spotted all along maze of over 150 miles of roads built on steep, winding benches. Tournatractor, with 2 to 3 times the speed of crawlers, produces major savings in work and travel time... gets more work done per day.

Less maintenance cost... less downtime

Tractor repair bills have also been cut, because tire-cushioned Tournatractors work over rocky surfaces without abrasion and shock damage. Crawlers, on the other hand, were a continual problem because of breakage and wear from rocks and grit in their track assemblies. Tournatractor's anti-friction drive is sealed, enclosed in rugged steel housings. Rocks and grit are sealed out, can't clog gears and rollers.

Maintenance of rubber-tired tractors has been easy, fast, economical. Operators report, for instance, that lube time is only one-third that needed for crawlers. These big LeTourneau-Westinghouse units are working long hours, too... one unit works 3 shifts a day, 7 days a week. Two others work 2 shifts a day. Downtime has been low. Strong, simple construction keeps Tournatractors working longer hours without breakdown.

Look into the money-making advantages of rugged, high-speed, rubber-tired LeTourneau-Westinghouse equipment in *your* operation. We'll furnish full details and arrange a working demonstration.

CT-1484-MQ-1

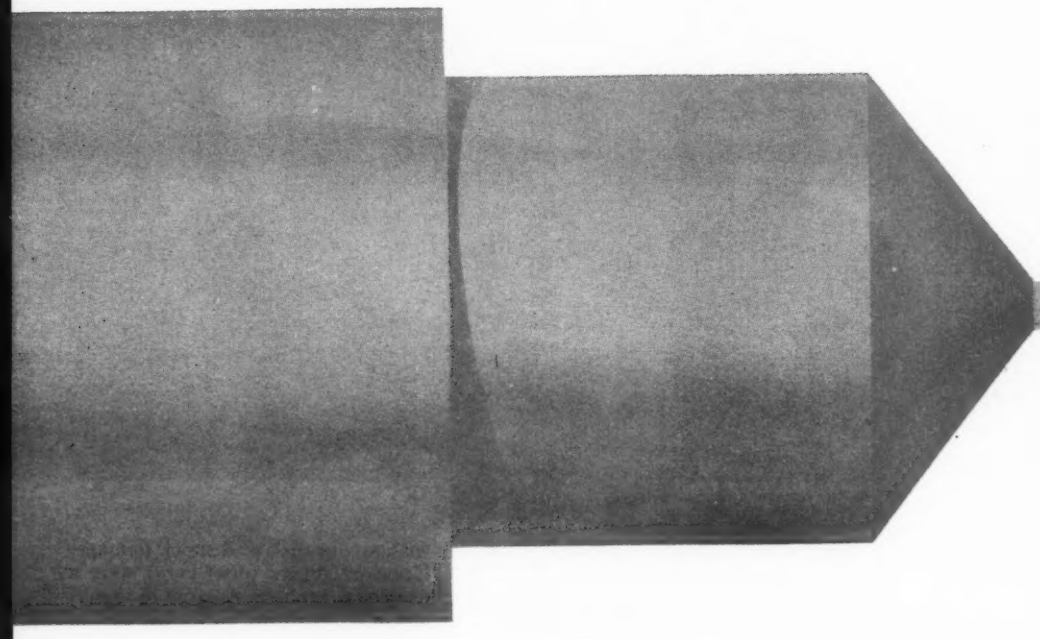
LETOURNEAU-WESTINGHOUSE COMPANY, PEORIA, ILLINOIS

A Subsidiary of Westinghouse Air Brake Company

Where quality is a habit

How STANDARD DIESEL FUELS

can help you cut coal hauler engine maintenance



You get three big benefits with STANDARD Diesel Fuels. They mean less engine maintenance, extended time between overhauls, more in-service operation per hauler—*and more profit on each ton of coal.*

1. **STA-CLEAN*—a Standard Oil exclusive.** This additive in STANDARD Diesel Fuels insures clean burning of the fuel, prevents fuel-injector sticking, minimizes rusting of fuel tank, fuel line and engine parts.
2. **Clean fuel.** Standard Oil exercises special care in handling your diesel fuel to make sure it is delivered to you *clean.* Contamination is eliminated. There's no foreign matter in the fuel to cause engine failure or maintenance problems.
3. **Balanced distillation** means you get good, economical engine performance. Cleaner engines mean better performance and longer periods in service between overhauls.

Check in with your Standard Oil industrial lubrication specialist for more facts about STANDARD Diesel Fuels. There's one of these specialists near you in any of the 15 Midwest and Rocky Mountain states. Or write Standard Oil Company, 910 South Michigan Avenue, Chicago 80, Illinois.

STANDARD OIL COMPANY
(Indiana)

*Trade Mark

Roebling Royal Blue Wire Rope goes to any length to prove its **high strength!**

Every inch of every foot of Royal Blue is stronger than any rope you've ever used on *any* job. This on-the-job tenacity helps to make it the most widely and readily accepted rope in Roebling's history. It is but one of Royal Blue qualities that makes for its long service life—on any job you choose. For full details on Roebling Royal Blue Wire Rope talk to your distributor or write to Wire Rope Division, John A. Roebling's Sons Corporation, Trenton 2, New Jersey, for your copy of "*Wire Rope Recommendations and Catalog*."

ROEBLING

Branch Offices in Principal Cities—Subsidiary of The Colorado Fuel and Iron Corporation

Above ground or down below

GARDNER-DENVER

helps speed production

A Gardner-Denver check list of fast, safe mining equipment

- ☐ "MOBILJUMBO"®
- ☐ Super 5½" DH143 Drill
- ☐ Deluxe "Air Trac"®
- ☐ "Air Trac"
- ☐ Wagon Drills
- ☐ Deep Hole Drills
- ☐ Ring Seal Shanks, Sectional Drill Rods
- ☐ Sinkers
- ☐ Breakers
- ☐ Tampers
- ☐ Air Tools
- ☐ Hydraulic Drill Jumbos
- ☐ Hydraulic Drill Support
- ☐ Pneumatic Columns
- ☐ Drill Steel Forges
- ☐ Bit Grinders
- ☐ Line Oilers
- ☐ Automatic Stopers
- ☐ Chain Feed Drifters
- ☐ Screw Feed Drifters
- ☐ Air Leg Drills
- ☐ Air Feed Legs
- ☐ Air Motors
- ☐ Air Hoists
- ☐ "Airslushers"
- ☐ Shaft Muckers
- ☐ Mine Car Loaders
- ☐ Sump Pumps
- ☐ Dewatering Pumps
- ☐ Grout Pumps
- ☐ High-Pressure Pumps
- ☐ Centrifugal Pumps
- ☐ Rotary Portables
- ☐ Stationary Compressors

See your Gardner-Denver mining equipment specialist or write for bulletins

ENGINEERING FORESIGHT—PROVED ON THE JOB
IN GENERAL INDUSTRY, CONSTRUCTION, PETROLEUM AND MINING

GARDNER - DENVER

Gardner-Denver Company, Quincy, Illinois
Gardner-Denver Export Division, 233 Broadway, New York 7, New York
In Canada: Gardner-Denver Company (Canada), Ltd., 14 Curity Avenue, Toronto 16, Ontario

Now for air legs! a removable bit that's one-piece strong!

Here is a removable bit for air-leg drills that has the strength of one-piece steels. It's the new Timken® tapered socket bit. The tapered union gives you all the advantages of removability and a strong secure union for use with air-legs.

Because the new Timken tapered bit is removable, you get all these advantages that intraset steels can't provide:

You don't have to throw away the drill steel just because the carbides wear out. You do with intrasets.

You carry a few bits down into the mine instead of a load of steel. You can't with intrasets.

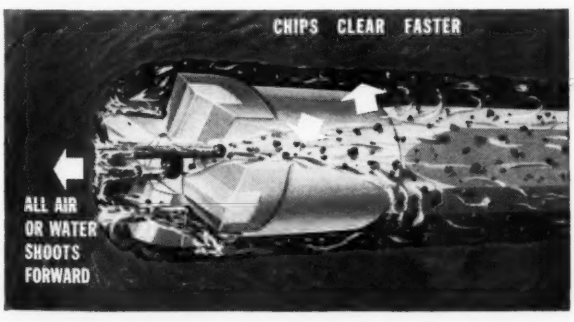
You can quickly change bit gauge sizes using the same steel. You can't do this with intrasets.

You don't have to lug the whole steel back just to resharpen the cutting edges. You do with intrasets.

You get four carbide cutting edges. You get only two with chisel intrasets.

And the new frontal design of the Timken tapered bit gives you faster chip clearance because 1) new five front holes shoot water or air directly against the rock face and 2) new deeper, wider wing clearance lets chips wash back faster. New special-analysis carbide inserts give superior wear-resistance with added shock-resistance, can be reconditioned many times.

For removability *and* strength, use the air-leg bit of the future. Write for our free brochure. The Timken Roller Bearing Company, Rock Bit Division, Canton 6, Ohio. Cable: "TIMROSCO".



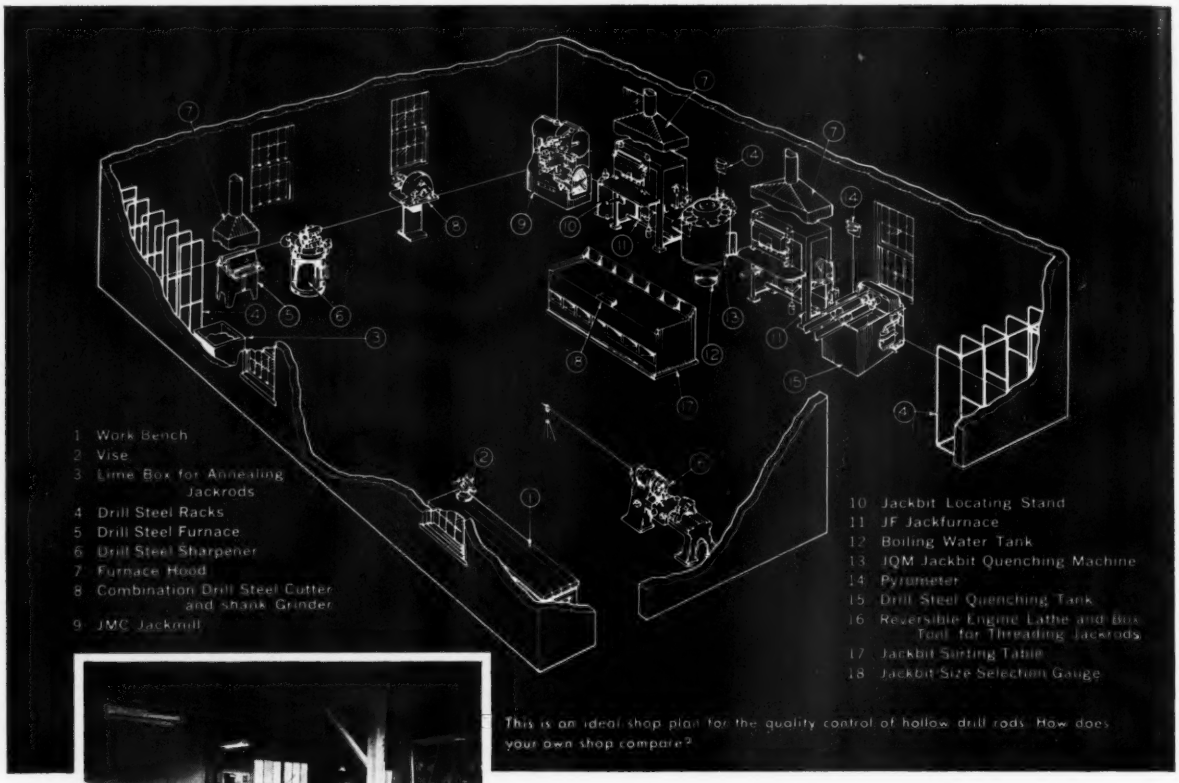
TIMKEN

TRADE-MARK REG. U. S. PAT. OFF.

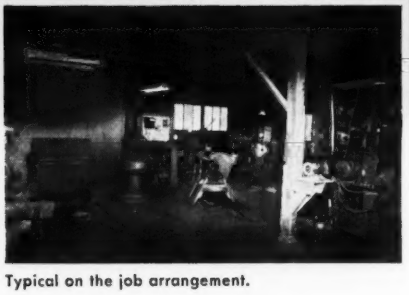
AVAILABLE NOW...
THE AIR-LEG BIT OF THE FUTURE

See the next Timken Televent hour, "The Innocent Years" over NBC-TV, Thursday night, November 21st.

how to get the most out of HOLLOW DRILL RODS



This is an ideal shop plan for the quality control of hollow drill rods. How does your own shop compare?



Typical on the job arrangement.

To bring you the best drill rods possible, manufacturers spend many thousands of dollars each year in development and testing. Crucible, for example, put more than half a hundred different alloys through their paces before CA DOUBLE DIAMOND and 4E Alloy Hollow Drill Rods proved the answer to lower cost drilling.

But to get the most out of modern drill steels, you've got to *maintain* their fine quality *after they reach your shop.*

The Answer is Quality Control

Unintentional abuse of drill steel by improper forging, machining, heat treating and other shop operations, produces a rod that is bound to give poor performance.

That's why full time supervision on operations such as these can mean longer drill life on the job:

1. Check heat treating process. Overlap heats for proper time.
2. Check furnace and forging temperatures.
3. Check annealing process to insure correct hardness.
4. Check Rockwell hardness of shanks and thread ends.
5. Check fit of bits on newly threaded rods.
6. Check location and severity of metallurgical notch.
7. Examine all rods returned from the job and determine reason for failure.

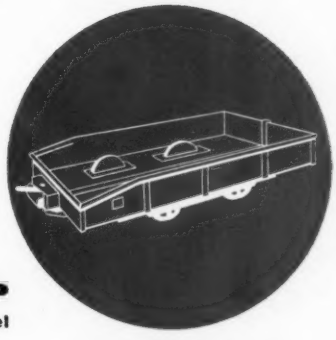
Shop control of this type actually saves money by eliminating many rod failures on the job. Personnel will be enthusiastic in reporting improved rod performance, and you'll be getting lower cost per foot of hole drilled.

Your nearby Crucible representative will be glad to supply helpful information on other phases of drill rod care and operation – or arrange for *prompt* deliveries of hollow drill rods in the sizes, grades, and types you need. *Crucible Steel Company of America, The Oliver Building, Mellon Square, Pittsburgh 22, Pa.*

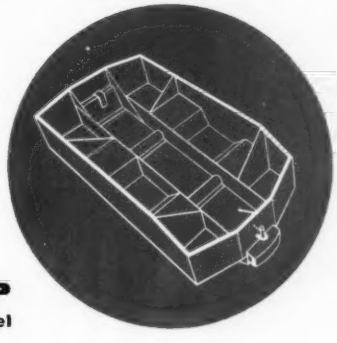
CRUCIBLE first name in special purpose steels

Crucible Steel Company of America

DROP BOTTOM
4 wheel or 8 wheel



END DUMP
4 wheel



ROTARY DUMP
4 wheel or 8 wheel

acf MAKES ALL THREE TYPES

No matter what type of car your mining operations call for acf has a car to fit your needs. acf mine cars are built in all types and sizes from 2 to 30 tons, or more.

For safety, low maintenance and high speed constant haulage all acf mine cars have special features developed through many years of experience in design and manufacture.

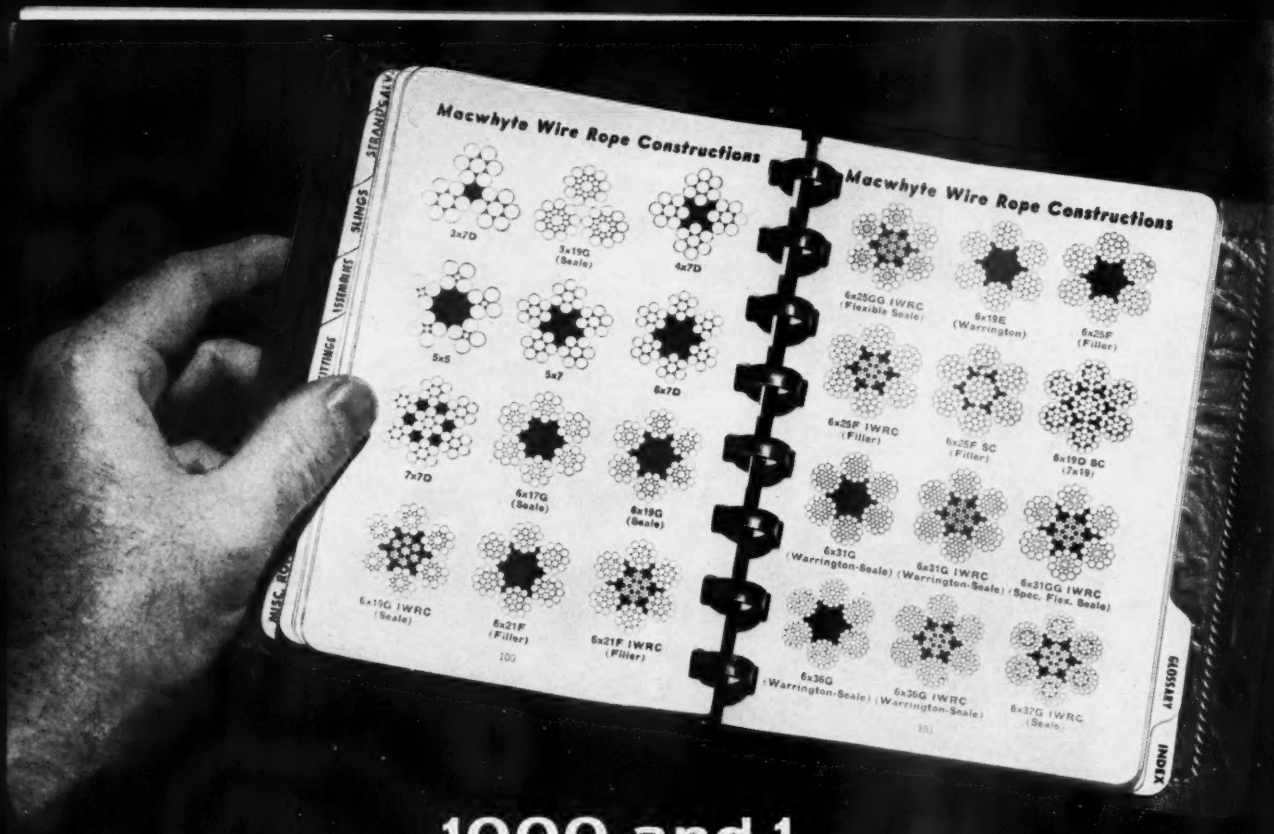
Anti-friction bearings in the load-support wheels permit safe high speed from loading point to unloading point and back again for more. Automatic couplers make car handling safer and faster. acf double-action spring bumpers lower maintenance on everything from trackage to locomotive...provide smoother, safer hauling.

For complete information about the full line of acf Constant Haulage Mine Cars in all sizes and types contact the nearest acf sales office or discuss your haulage problems with one of our sales representatives.

acf **MINE CARS**
FOR CONSTANT HAULAGE

AMERICAN CAR AND FOUNDRY
Division of acf Industries, Incorporated

Sales Offices: New York • Chicago • St. Louis • Cleveland • Washington, D. C. • Philadelphia • San Francisco • Berwick, Pa. • Huntington, W. Va.



1000 and 1

WHYTE STRAND

WIRE ROPES

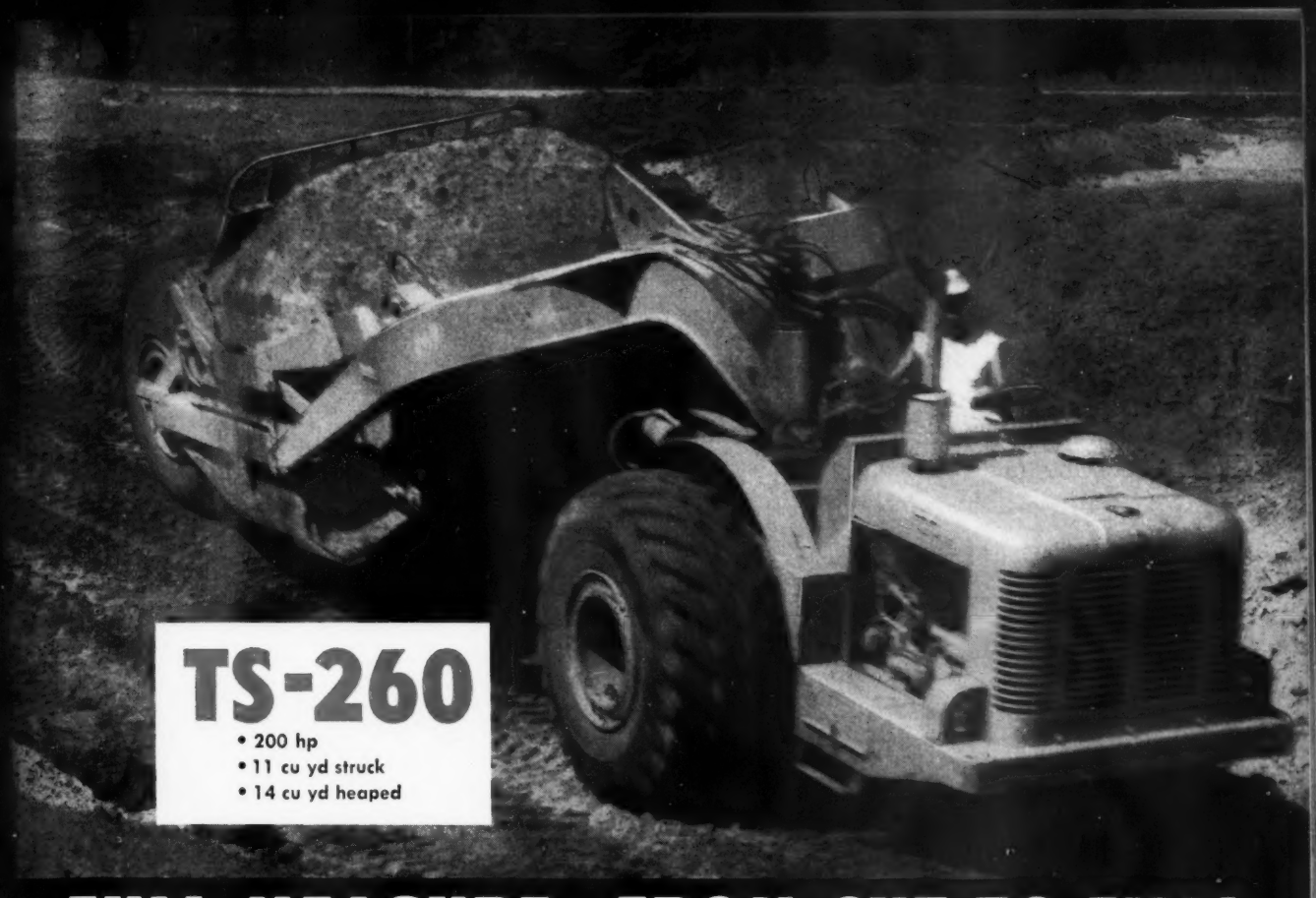
Each designed to give you the correct wire rope for your equipment. Whatever your equipment needs, there is a Macwhyte Wire Rope to serve you the sure, dependable way. WHYTE STRAND Wire Ropes by Macwhyte are produced to meet every job specification under all conditions, PREformed for flexibility, and Internally Lubricated for outstanding service. Macwhyte Wire Rope is available in stock for immediate delivery.

Macwhyte General Wire Rope Catalog G-16 will prove invaluable to you. For your free copy, write on your company letterhead to:

MACWHYTE COMPANY
2906 Fourteenth Avenue, Kenosha, Wisconsin

Manufacturers of Internally Lubricated PREformed Wire Rope, Braided Wire Rope Slings, Aircraft Cables and Assemblies, Monel Metal, Stainless Steel and Plastic Coated Wire Rope, and Wire Rope Assemblies. Special catalogs available.

MILL DEPOTS: New York 4, 35 Water St. • **Pittsburgh 36,** P. O. Box 10916, 353 Curry Hollow Road • **Detroit 3,** 75 Oakman Blvd. • **Chicago 6,** 228 S. Desplaines St. • **St. Paul 14,** 2356 Hampden Ave. • **Fort Worth 1,** P. O. Box 605 • **Portland 9,** 1603 N. W. 14th Ave. • **Seattle 4,** 87 Holgate St. • **San Francisco 7,**



FULL MEASURE—FROM CUT TO FILL!

Big Diesel Power . . . Allis-Chalmers 844-cu in. engine delivers more power per pound of gross vehicle weight . . . more torque when loading . . . more *drive* when hauling and spreading.

Correct Weight Distribution. When empty, 66 percent of weight is carried on tractor wheels for greater driving ability. When loaded, the total weight is equally distributed on each of the four wheels for maximum flotation, traction and tire life.

Exceptional Maneuverability with fast, positive 90° steering. Positions quickly in the cut, moves fast off the fill. Two-stage hydraulic steering maintains accurate control on the haul road.

The TS-260 also offers true "boiling action" loading . . . positive forward forced ejection for quick, clean spreading . . . heavy-duty power train . . . and many other advantages you'll have to *see* to fully evaluate. Ask your nearby Allis-Chalmers dealer for a working demonstration soon, on *your* job, and see why the profit-producing TS-260's are making new friends every day. Allis-Chalmers, Construction Machinery Division, Milwaukee 1, Wisconsin.

ALLIS-CHALMERS

Engineering in Action

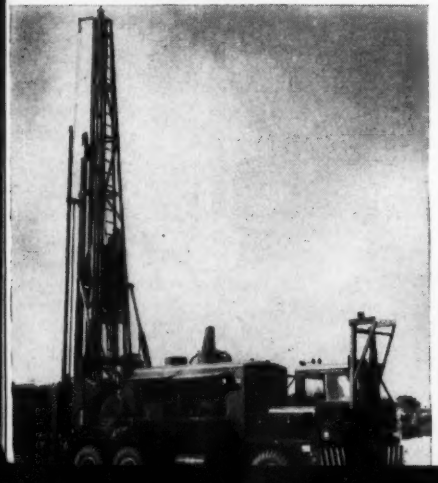
Special auxiliary wheels . . . to meet highway weight limits. Twin front wheels are attached quickly and easily to distribute weight . . . let you move the TS-260 between jobs on its own power.

Ingersoll-Rand

DRILLMASTER

"TRACM" MOUNTING

"TRUCM" MOUNTING



OUTSTANDING PERFORMANCE

On job after job, Ingersoll-Rand Drillmasters are sinking 200 ft or more of 6-inch blast holes per day. Not just occasionally, but day after day on a routine production basis. That's why so many users have hailed the Drillmaster as the most productive blast hole drilling unit ever developed.

Completely self-powered and self-propelled, the Drillmaster meets every drilling requirement. Use it with the I-R down-the-hole drill, or as a rotary drill. In any type of ground, Drillmaster performance is its own best recommendation.

AND VERSATILITY TOO

In addition to the complete crawler-mounted Drillmaster, you can also obtain the basic Drillmaster and compressor unit for mounting on your own tractor or truck. The "TRACM" mounting is ideal on rough terrain — takes your Drillmaster anywhere a tractor can go. The "TRUCM" mounting saves time, effort and expense on jobs of short duration. For complete information, send today for Drillmaster Bulletin No. 4179.

A Constant Standard of Quality in everything you need for drilling rock

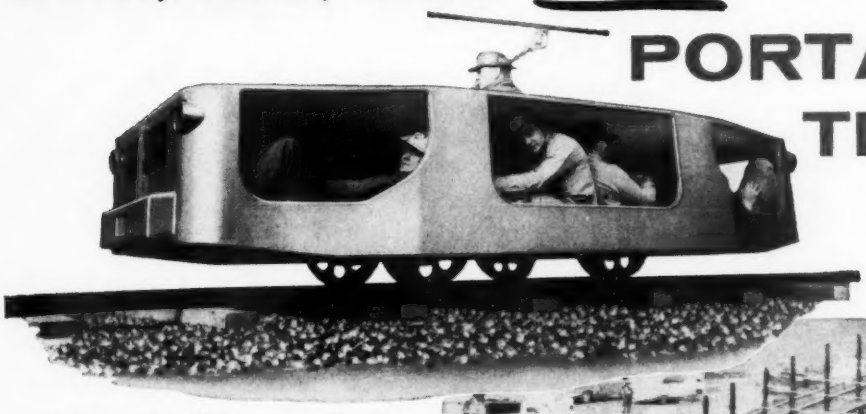
Ingersoll-Rand

5-696

11 Broadway, New York 4, N. Y.

COMPRESSORS • HYDRA-BOOMS • WAGON-DRILLS • CRAWL-IR • DRIFTERS • JACKHAMERS

You, too, can *reduce* PORTAL TIME *up to 50%!*

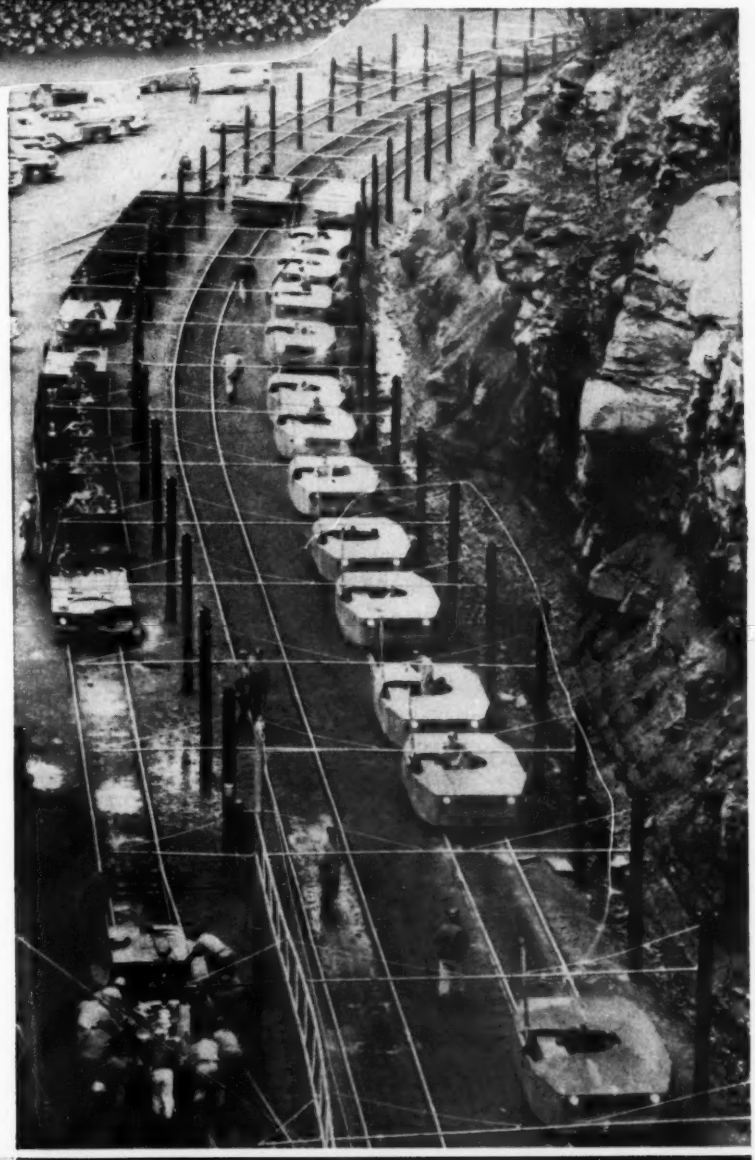


TJ5 Mine Portal Bus, "Low Type"

Lee-Norse *Self-Propelled* MINE PORTAL BUS

Factual performance records prove that the Lee-Norse Mine Portal Bus can effect up to 50% savings in portal time . . . savings that result in more man hours at the section face . . . increased tonnage at a reduction in overall cost per ton.

Built in low and high types to suit your haulage road, the Mine Portal Bus features complete safety —two separate braking systems . . . split-roof design that allows operator full vision at all times.



Get your personnel to and from the working face quicker . . . safer! Check the advantages of the Lee-Norse Mine Portal Bus.

Lee-Norse Company

Specialists in Coal Mining Equipment

CHARLEROI, PA.

Repeat Orders Follow Fine Performance of Bucyrus-Erie Rotary Blast Hole Drill

Early in 1955 the Central Ohio Coal Co. put a Bucyrus-Erie 50-R rotary blast hole drill into operation at its mine near Zanesville. The output of this drill was watched carefully, and a decision was soon reached: footage records called for conversion to 50-Rs at an early date. Accordingly, three more of these Bucyrus-Eries were subsequently added.

In pit after pit the story is the same — those who buy Bucyrus-Erie rotaries soon want to switch over exclusively to these moneymakers. Among the reasons for this preference are the following:

★ *Maximum controlled penetration* through hydraulically powered down pressure on the bit.

★ *Most efficient drilling speed* for a given formation because of Ward Leonard electric control on rotation of the drill stem.

★ *Continuous drilling of hole* for the full length of the drill pipe — 32 ft. 9 in. on the 50-R; 27 ft. 9 in. on the 40-R.

★ *Elimination of manual effort* when adding or removing drill pipe, made possible by remote-controlled, power-driven drill pipe rack.

★ *Air cooling of the bit* by compressed air.

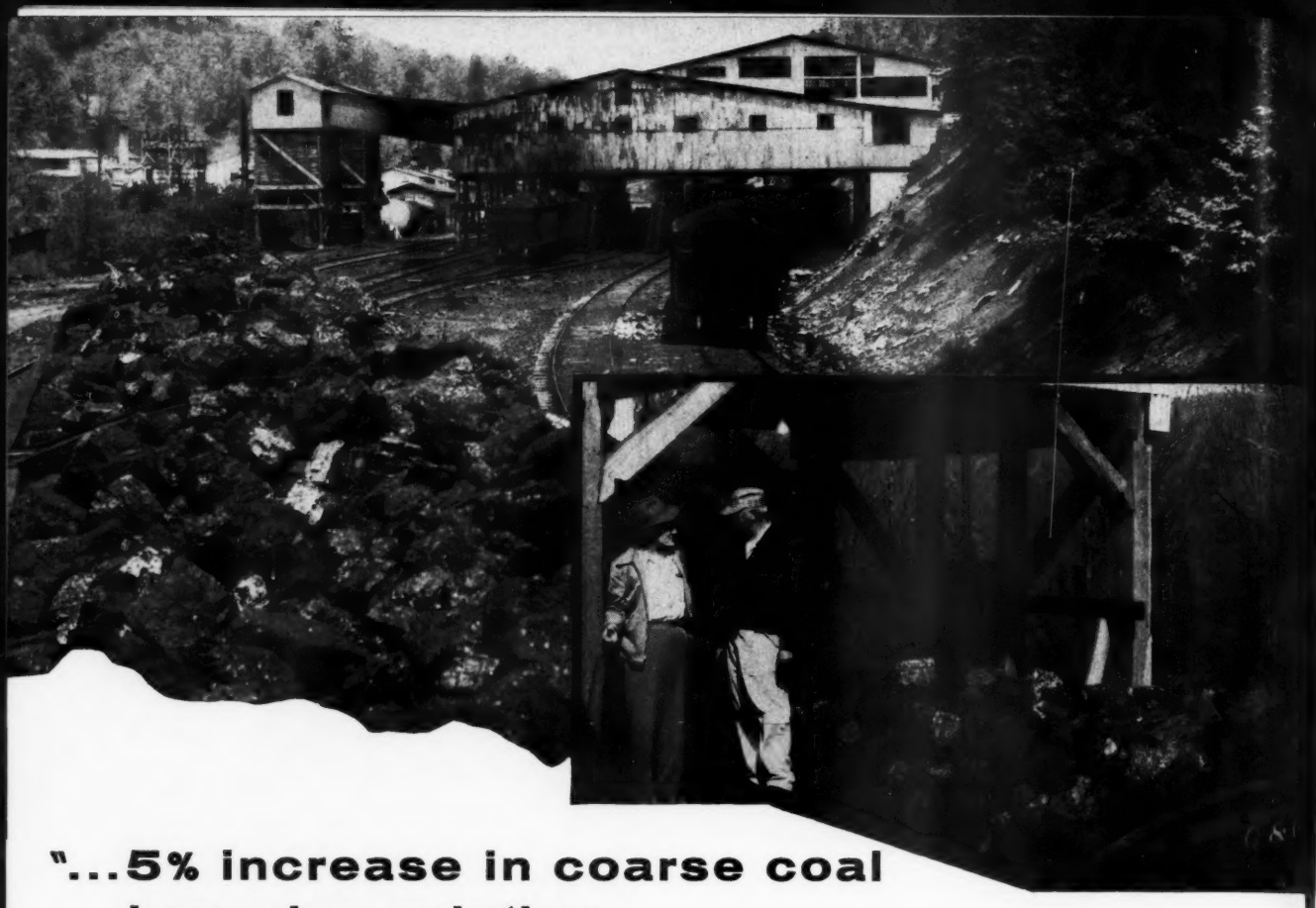
★ *Efficient removal of cuttings* — fine cuttings are picked up and handled by a Roto-Clone precipitator; heavies pile up adjacent to the drill hole for use as stemming material.

Bucyrus-Erie rotaries are available in two sizes — the 40-R (equipped with either diesel-electric or full electric power) for drilling 6¾- to 9-in. holes, and the 50-R (electric only) for drilling 9⅞- to 12¼-in. holes. For detailed, illustrated literature, write today.

52B57 C

BUCYRUS ERIE

South Milwaukee, Wisconsin



"...5% increase in coarse coal ...less degradation with AIRDOX"

NON-EXPLOSIVE MINING METHOD

AIRDOX

NON-EXPLOSIVE MINING METHOD

Cuts Costs 5 Ways

- Produces less fines in face preparation
- Rolls coal forward for faster, easier loading
- Easier on "tender" roofs—cuts timbering, bolting
- Lowers cleaning costs by minimizing fines
- Reduces degradation—no shattered coal

NEW RIVER IMPERIAL SMOKELESS

states J. G. McCURRY
General Manager
Imperial Smokeless Coal Company

"We have been using the Airdox method of mining for some five years now in all our deep mines. We gave it a very thorough test period and compared the results with other methods of blasting. Airdox gave us an increase of more than 5% in coarse coal. Moreover, our customers report there is *noticeably less degradation* of coarse coal when unloaded at its destination.

"We have a new mine opening this fall and expect to stay 100 per cent on Airdox."

GET ALL THE FACTS • WRITE FOR FREE SURVEY

CARDOX CORPORATION • 307 NORTH MICHIGAN AVENUE, CHICAGO 1, ILLINOIS

WAREHOUSES and DISTRICT OFFICES

The how and why of Bethlehem Switch Heel Blocks

This shop-assembled sample clearly shows the how and the why of Bethlehem's new Switch Heel Block Design 992, which was developed especially for use with mine turnouts. When properly installed in the turnout, as shown, the 992 helps maintain heel spread and track gage at the heel end of the switch, keeping closure rail and switch point in correct alignment both vertically and horizontally.

Included with the sample are short lengths of rail, serving as stock rail (right), closure rail (upper left) and switch point (lower left). Assembly is a quick and simple matter and results are foolproof.

The block itself is the sturdy little weldment between rails. Two bushings welded to the left-hand side of the block slip through holes drilled in the switch point, thus permitting the bolts to be drawn up tight without hindering normal lateral movements of the points.

The Design 992 can be furnished to fit switches of any length and rail from 40 lb per yard and up. It can make an important contribution to the smooth, fast and efficient transportation your mine wants and needs for up-to-the-minute operations. A Bethlehem engineer, located in a nearby district office, will be glad to discuss the Design 992 Switch Heel Block in terms of your particular requirements.

BETHLEHEM STEEL COMPANY, BETHLEHEM, PA.

On the Pacific Coast Bethlehem products are sold by Bethlehem Pacific Coast Steel Corporation
Export Distributor: Bethlehem Steel Export Corporation

BETHLEHEM STEEL

BETHLEHEM STEEL

3 "Eucs" haul 150 to 175 loads per day at Fairfax Quarries

Each averages 54 trips daily on 1/4 mile rock haul

Adjacent to the site of the historic Battle of Bull Run, Fairfax Quarries produces 1500 tons of aggregates every 10-hour working day. This is one of five quarries of C. S. Luck, Jr. in Virginia. Like clockwork, three 15-ton "Eucs" haul blasted rock to the hopper—they are loaded by a 1½ yd. shovel and make 900 trips each week. Two other Rear-Dump Euclids of the same capacity are utilized for overburden removal. In all, Luck is using 20 Euclids at his five quarries to keep production moving smoothly and steadily. Three out of four of all the off-highway haulers working at Luck's quarries are "Eucs."

Before you buy any haulage units, investigate Euclid equipment—it has reduced hauling costs on hundreds of mine, quarry and industrial operations. Your Euclid dealer will be glad to provide you a production-cost estimate for your operation as well as information on the complete line of Rear-Dumps, Scrapers, Bottom-Dumps and Crawler Tractors. Have him show you why ***Euclids are your best investment.***

EUCLID DIVISION GENERAL MOTORS CORPORATION, Cleveland 17, Ohio

Euclid Equipment

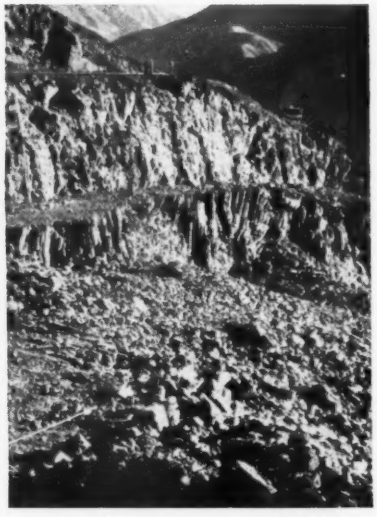
FOR MOVING EARTH, ROCK, COAL AND ORE

NEW RESULTS OF MONSANTO RESEARCH IN USE OF AMMONIUM NITRATE AS AN EXPLOSIVE

Typical shot with Monsanto's new kind of prilled NH_4NO_3

View of area involved in the blast. Shot was made in heavy columnar basalt at dam site. Used as an explosive: a new, top-quality, prilled NH_4NO_3 that Monsanto research developed to give you optimum savings, safety, speed and ease of handling.

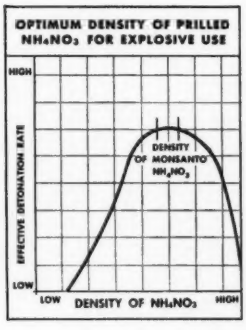
View at time of detonation. The system of detonation recommended by Monsanto, in conjunction with Monsanto Ammonium Nitrate, will yield equivalent pound-for-pound results with 60% gelatin dynamite at one-fourth the cost.

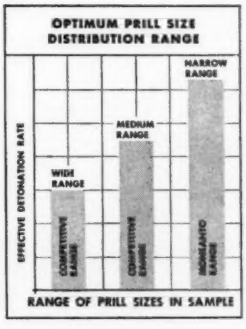


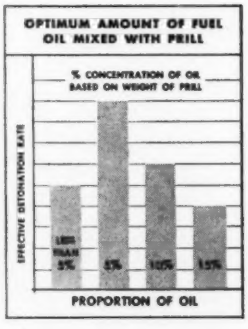
Results of blast. The powder factor in the shot above was 0.4 lbs. per cubic yard. Breakage of rock was considered ideal by contractor. Monsanto's experienced staff can give you complete technical service. Just phone Monsanto.

Photos courtesy of MORRISON-KNUDSEN COMPANY, INC.

Monsanto Ammonium Nitrate is now produced according to the specifications determined by these findings of Monsanto research. Result: more effective blast at greater savings. Monsanto is the world's largest manufacturer of prilled ammonium nitrate—and leader in developing the use of NH_4NO_3 as an explosive for open work. Request report presenting latest research findings.







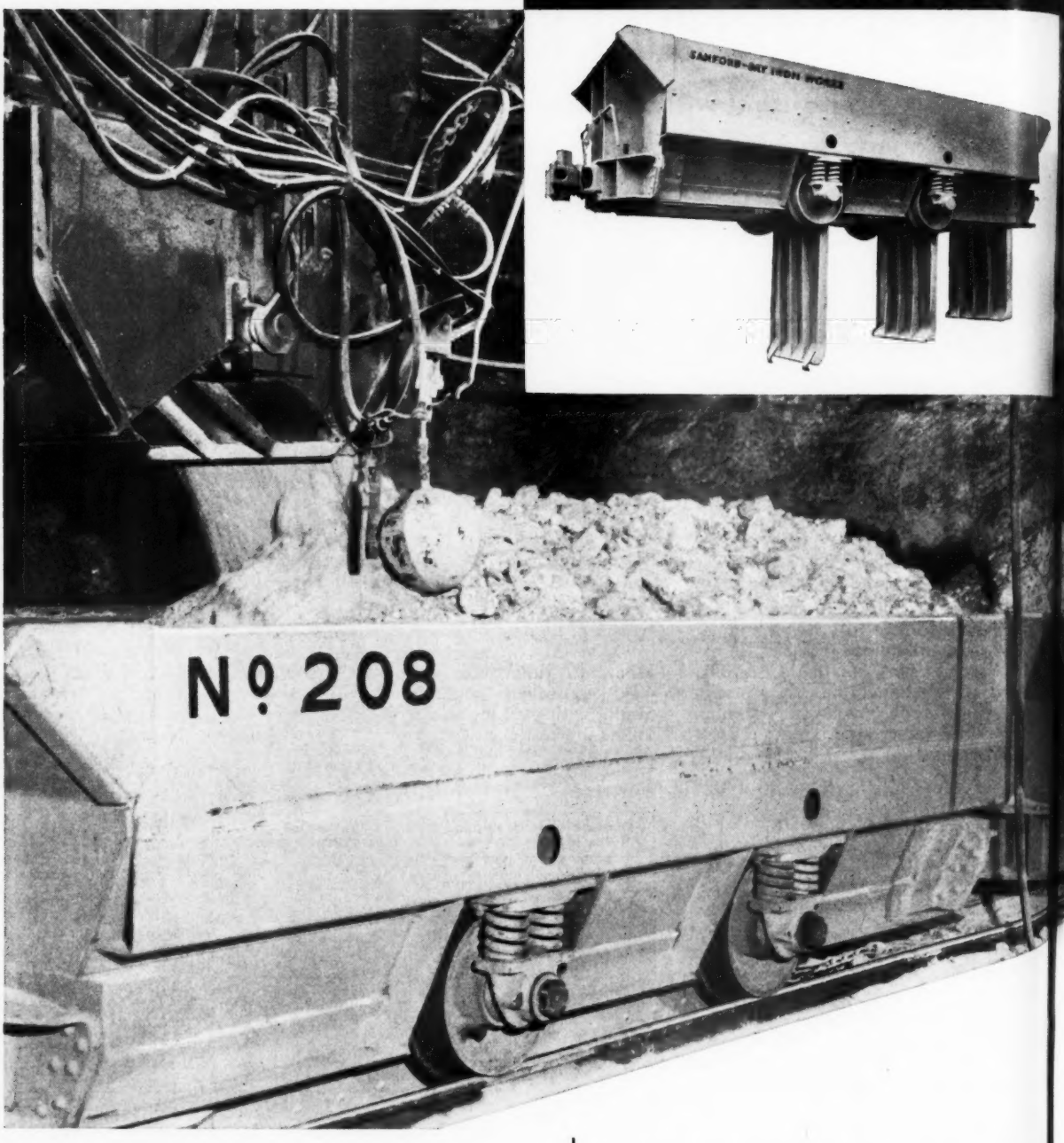
CALL ST. LOUIS WYdown 3-1000 COLLECT—
OR WIRE NOW FOR COMPLETE INFORMATION

MONSANTO CHEMICAL COMPANY
Inorganic Chemicals Division
Dept. E-1, St. Louis 24, Missouri
In Canada: Monsanto Canada Ltd., Montreal

Monsanto®

Where Creative Chemistry Works Wonders For You

These S-D AUTOMATICS

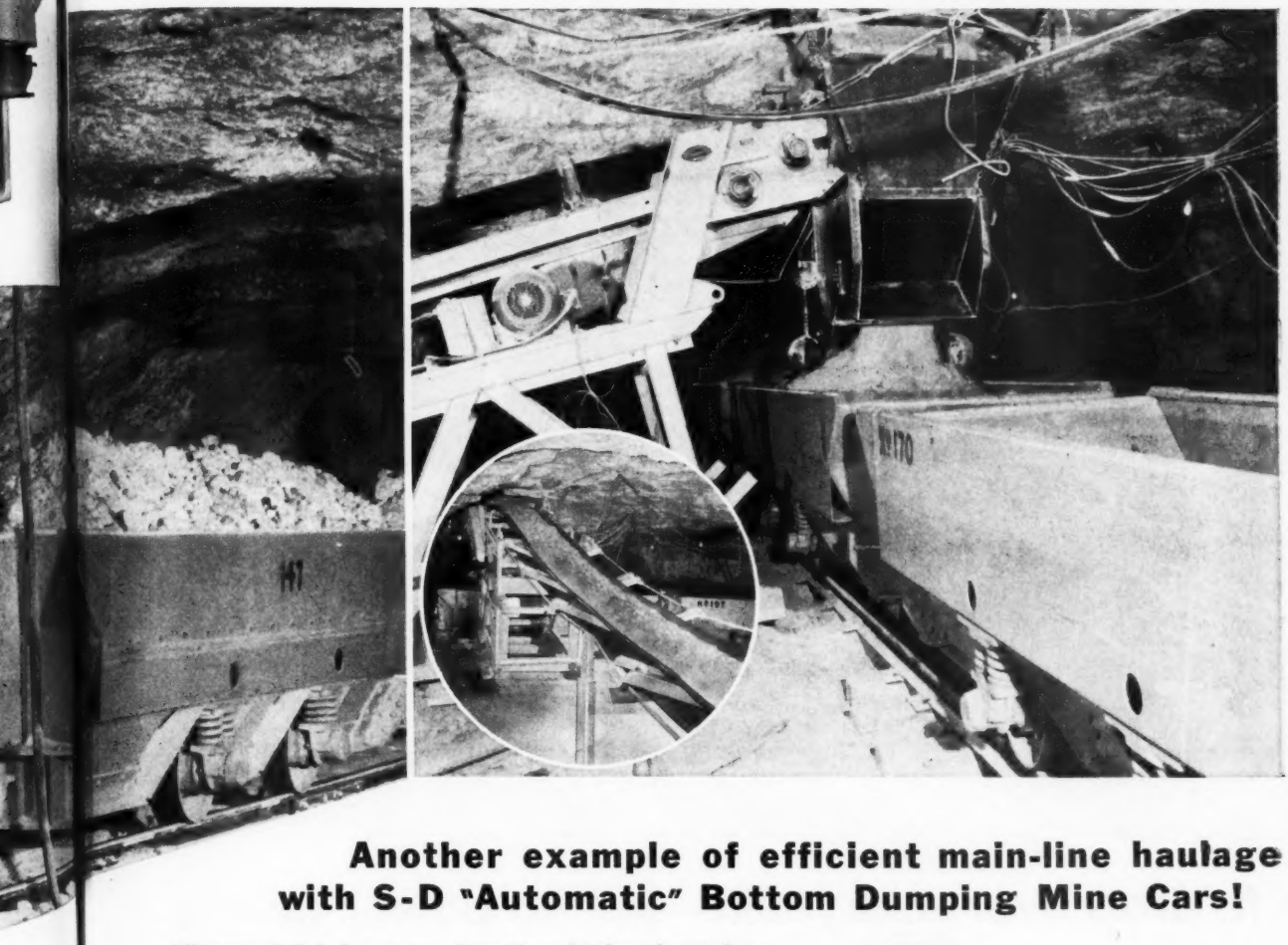


SANFORD-DAY

Knoxville, Tennessee

"SUPER MARKET FOR MINE CARS" — *all types* * PRECISION WHEELS * "BROWNIE" HOISTS, CAR RETARDERS, SPOTTERS, PUMPS AND OIL SPRAY SYSTEMS * GISMO SELF-LOADING TRANSPORT that loads *(mucks)* in development or production . . . transports . . . supports 2 to 5 jib mounted drills . . . back fills . . . moves boulder rocks . . . makes its own roadways and cleans up completely — a new method of hard rock mining offering a tremendous reduction in cost per ton!

have been in service at U. S. Potash 3 years...working 363 days per year, two shifts per day on a seven-mile run!



Another example of efficient main-line haulage with S-D "Automatic" Bottom Dumping Mine Cars!

"Because of their low center of gravity and balanced rugged construction, they hold the track exceptionally well at speeds up to 30-miles-per-hour," reports Mr. Earl H. Miller, resident manager of the Carlsbad, N. M., mining operation of United States Potash Company, Division of United States Borax & Chemical Corporation.

"Also," Mr. Miller continues, "the door operation is very good, allowing the cars to do a good job of self-cleaning." How does the maintenance costs of these cars compare with conventional type ore cars? "We have had very low maintenance costs on the S-D 'Automatics' compared to others we are using."

Note in pictures above and on page at left that mining management at U. S. Potash have further mechanized their main-line haulage with an automatic loading station. We are understandably proud that S-D "Automatics" were chosen for this U. S. Potash operation that incorporates the latest developments in modern simplicity and efficiency. In addition to this installation, S-D "Automatics," like the car illustrated at right, are hauling hard rock in several western mines at tremendous savings! Write us today for complete information. *Sanford-Day Iron Works, Inc., Knoxville, Tennessee*

60 ft. drop over rocky cliff—yet no power failure with Anaconda Mine Power Cable!

This cable is exposed to about as rugged a set of conditions as any cable is likely to meet. It has been pulled over sharp rocks . . . dropped over a 60 ft. cliff . . . and lies unprotected under sun and harsh weather day after day. Yet it has given unfailing service.

Why? Anaconda Mine Power Cable is designed and made by people who know *both* mining and cable engineering!

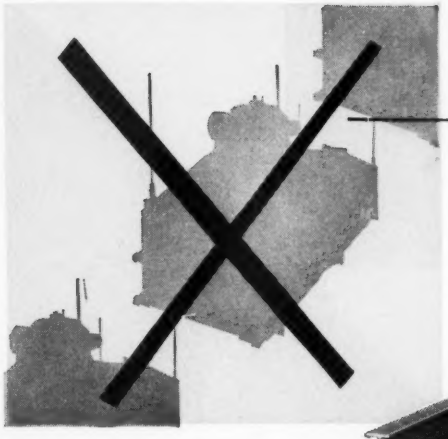
NEOPRENE JACKET is extra tough . . . has real flexibility and great strength. It resists abrasion, mechanical abuse, flame and water.

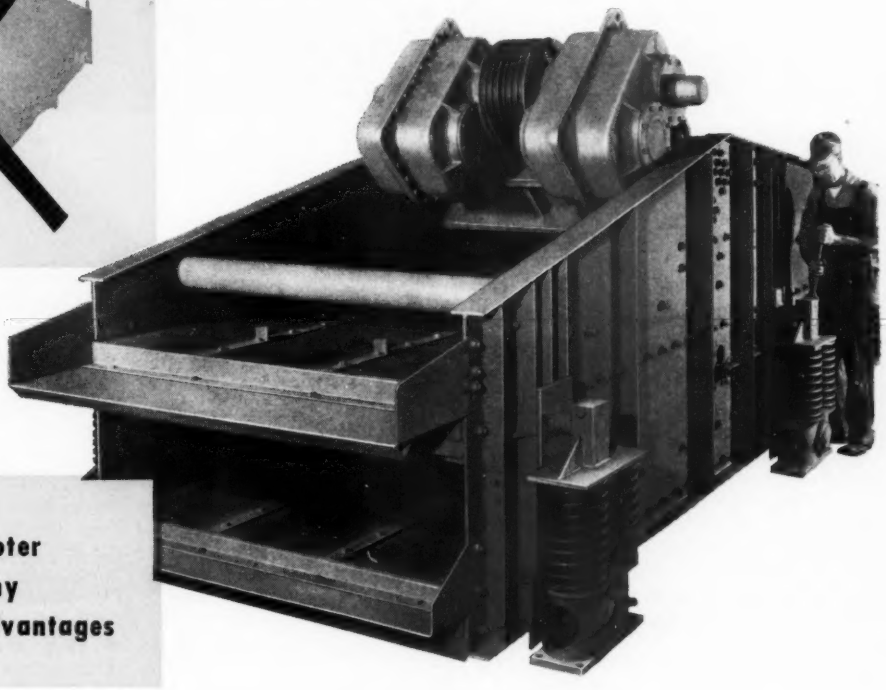
BUTYL INSULATION has superior long-aging characteristics . . . excellent resistance to ozone, heat and moisture. And it has high dielectric strength.

The Man from Anaconda or your Anaconda Distributor can give you full information about this durable, low-cost mine power cable. Or write: Anaconda Wire & Cable Company, 25 Broadway, New York 4, N. Y. 073221

SEE YOUR ANACONDA® DISTRIBUTOR FOR MINE POWER CABLE

NOW one BIG SCREEN does the work of multiple units





Husky 20-footer offers many profit-building advantages

Volume — This single, high tonnage *Low-Head* vibrating screen is a unit that out-produces a series of two or more screens in coal, metal mining and rock products fields.

Multiple operations on one screen — Operations in sequence, such as draining, washing and dewatering, are accomplished on one big Allis-Chalmers screen.

Cut Cost... Save Space

Obviously, in the application of a single unit, installation cost is considerably less than that of multiple units. Feeding arrangements are simpler. Collecting hoppers and chutes are easier to install. Maintenance costs are proportionately lower. And, of course, a single big unit takes up less space than a multiple unit installation.

For complete information, see your Allis-Chalmers representative or write Allis-Chalmers, Industrial Equipment Division, Milwaukee 1, Wisconsin. Ask for Bulletin 07M7500-111.

Low-Head is an Allis-Chalmers trademark.

ALLIS-CHALMERS

A-C ALLIS-CHALMERS

A-5485

The Hallmark of Circulation Value

Three thousand four hundred and fifty advertiser, agency and publisher members of the Audit Bureau of Circulations have a voice in establishing and maintaining the standards responsible for the recognition of this emblem as the Hallmark of Circulation Value. It represents the standard of value that these buyers and sellers of advertising space have jointly established as measurement for the circulation of printed media.

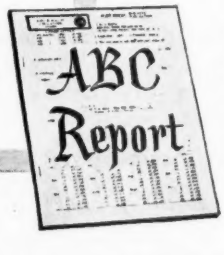
The basis for arriving at the advertising value of a publication is the Bureau's single definition of net paid circulation. With this as the standard, the circulation records of A.B.C. publisher members are audited by experienced circulation auditors. As specified in the Bureau's Bylaws, A.B.C. auditors have "access to all books and records."

Subscription and renewal orders, payments from subscribers, paper purchases, postal receipts, arrears are among the publisher's circulation records that are painstakingly checked by auditors and the resulting data are condensed and published in A.B.C. Reports.

Experienced space buyers use the audited information in A.B.C. Reports as a factual basis for their decisions in evaluating, comparing and selecting media. The FACTS in A.B.C. Reports for business publications include: • How much paid circulation • How much unpaid distribution • Occupational or business breakdown of subscribers • Where they are located • How much subscribers pay • Whether or not premiums are used • How many subscribers in arrears • What percentage of subscribers renew.

SEND THE RIGHT MESSAGE TO THE RIGHT PEOPLE

Paid subscriptions and renewals, as defined by A.B.C. standards, indicate an audience that has responded to a publication's editorial appeal. With the interests of readers thus identified, it becomes possible to reach specialized groups effectively with specialized advertising appeals.



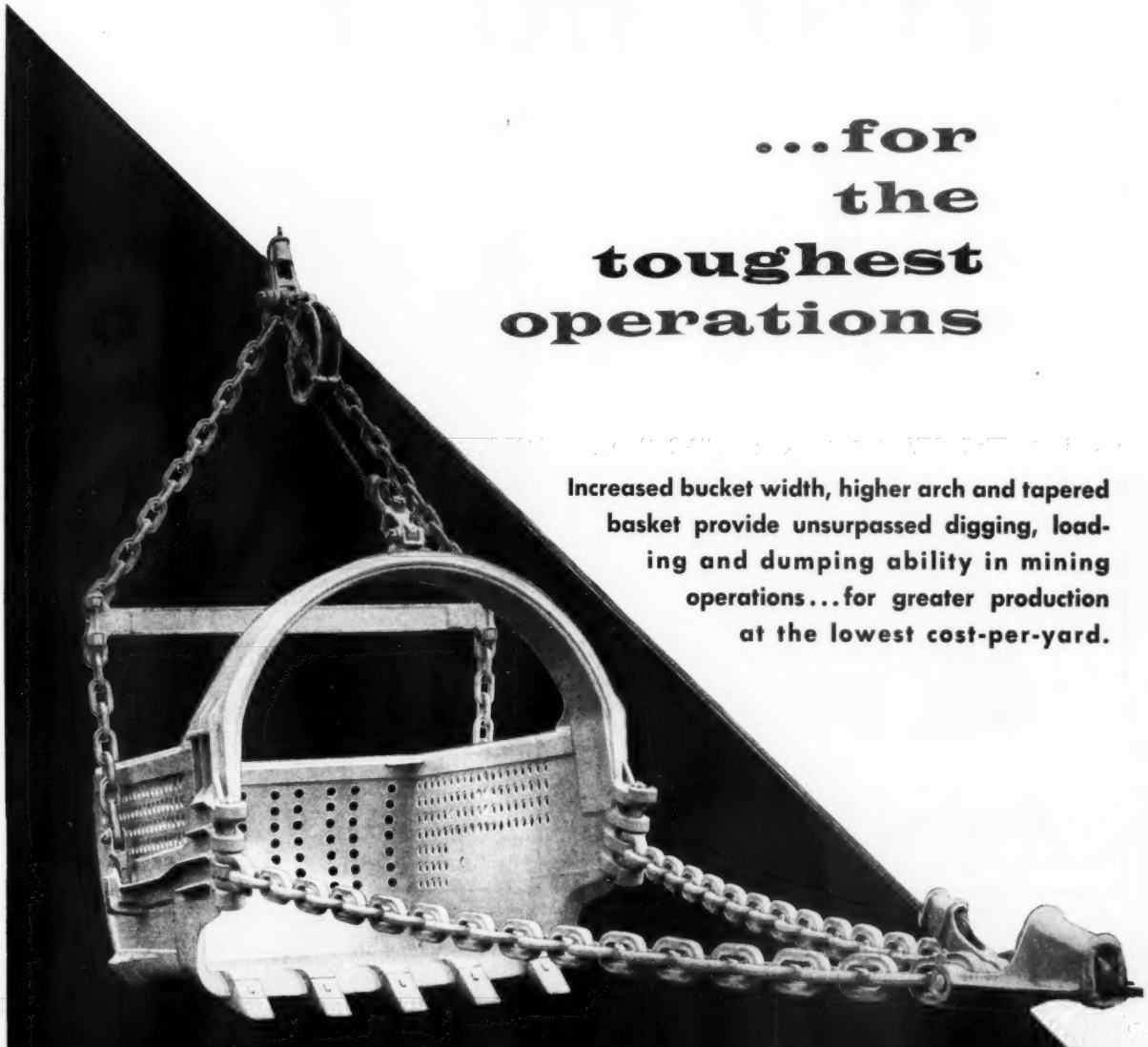
This publication is a member of the Audit Bureau of Circulations and is proud to display the Hallmark of Circulation Value as the emblem of our cooperation with advertisers. Ask for a copy of our A.B.C. Report and then study it.

MINING CONGRESS JOURNAL

A.B.C. REPORTS — FACTS AS A BASIC MEASURE OF ADVERTISING VALUE

"MH" HENDRIX

Heavy Duty Mining Buckets



...for the toughest operations

Increased bucket width, higher arch and tapered basket provide unsurpassed digging, loading and dumping ability in mining operations...for greater production at the lowest cost-per-yard.

4½ to 14 Cubic Yards With or Without Perforations

HENDRIX MANUFACTURING CO., Inc.
MANSFIELD, LOUISIANA

Hendrix Dragline Buckets

WHICH COSTS YOU MORE...

Buying Bits or

Changing Bits?

When non-productive man-hours are considered, changing bits can be more expensive than the cost of the bits alone. Idle loaders, timbermen or roof bolters, plus the time of the men changing bits all add a considerable amount to your cost per ton.

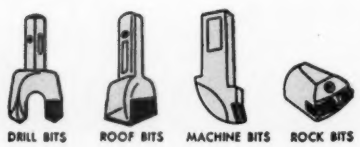
Kennametal* bits help you cut bit changing costs two ways. First, by staying sharp longer, Kennametal Bits mine more coal between changes, at a faster rate, with less power. In addition, with minimum "spotting," the consistently long life of Kennametal Bits enables you to *schedule* bit changes for normal maintenance periods.

Your Kennametal Representative can show you many other cost-cutting features throughout the complete range of Kennametal Bits for all cutting and drilling operations. Ask him about a test demonstration in your mine. See for yourself how Kennametal Bits can save *you* money. KENNAMETAL INC., Mining Tool Division, Bedford, Pennsylvania.

C-3073

*Trademark

INDUSTRY AND
KENNAMETAL
...Partners in Progress



EDITORIALS

ROBERT W. VAN EVERA, Editor

NOVEMBER, 1957

IMPORTANT WORK

THE Coal Division of the American Mining Congress has just held its annual conference in Pittsburgh. It was not a one-day convention, as such, but rather a technical conference at which the status of the many Coal Division studies was reviewed and plans for future work discussed. As an important by-product, however, the industry was brought up-to-date on the latest advances in mining techniques. A full report of the conference will appear in the January issue of MINING CONGRESS JOURNAL.

The AMC Coal Division fills a unique position in the coal industry. Members of the various committees attack mining problems, not as pure researchers, but as practical operating men striving to find better ways of producing coal for a competitive market. Just as important is the fact that the Coal Division is the one place where equipment manufacturers and mine operators meet on common ground—not as salesmen and customers, but as mining men in search of a common goal. Whatever the success of Coal Division work, it is based on the same axiom that has made America's industry so great—namely, that two heads are better than one.

Although the men who participate in this work are predominantly technical and operating personnel, the underlying theme of many of the Coal Division's studies is *safety*. Safe working conditions and practices go hand in hand with efficient and economical operations. We have, in the past, emphatically pointed out on this page that one cannot exist without the other. For instance, the Committee on Roof Action necessarily bases its work on the premise that roof falls, the number-one accident hazard of underground miners, must be curbed if improved efficiency and lower costs are to be realized.

That understood, the job becomes one of determining the best methods of designing roof bolt patterns, of selecting the most practical materials and equipment available for roof bolts and their installation, of adjusting to geologic variations in mine roofs, and of analyzing all other factors of roof control.

Similarly, committees studying dust control, underground power systems, automatic conveyor belt controls, and maintenance procedures are finding answers that have a direct bearing on safety.

Major accomplishments can be cited in the work of the Coal Division Committees. The report: "Specifications for Roof Bolting Materials" published in MINING CONGRESS JOURNAL in July 1956, has been approved as an American Standard by the American Standards Association, and thus provides an authoritative reference on roof bolting materials where none existed previously.

Another such example is the booklet by the Committee on Underground Haulage, "Construction and Maintenance of Rail Haulage Roads in Coal Mines." This booklet was revised and expanded in the past year and has also been submitted to ASA for acceptance as an American Standard.

Let it be clearly understood that the credit for technological advances made in the coal industry over the past 30 years belongs directly to the industry itself. Coal Division work has been an important function of Mining Congress staff members who are justifiably proud to be a part of the industry. But the real work has been done in the field. The coal committee organization is a catalyst in the overall equation, providing the setting to combine the best work of many men, and the outlet to distribute the results throughout the industry.

The greatest progress can come only when the industry gives its full cooperation. Those who benefit the most are those who work the hardest; but others, who find it impossible to contribute much time, stand to gain immeasurably by taking part in the committee work. By hearing the discussions and progress reports at the meetings, the more casual participants are brought up-to-date on matters that are not developed far enough to warrant publication in the industry's journals. The several group meetings during the year offer an excellent opportunity to mix with men in similar jobs, and often such contacts bring out important answers that can be applied directly in one's own operation.

We urge our readers in top management positions in the coal industry to support this work by sending deserving and qualified men to the meetings. These men invariably take pride in such recognition, and the younger ones gain a feeling of importance in being entrusted to represent their companies in the work of the AMC Coal Division.

PORTABLE POWER SYSTEMS FOR STRIP MINES

The growth of strip mining and the increased size of stripping units have given rise to new problems in electrical power distribution. Two authors use a practical and a technical approach to the subject and come up with conclusions on the proper design of power systems

By L. E. BRISCOE
Electrical Engineer
Ayrshire Collieries Corp.

ELECTRIFICATION of strip mining during the latter part of the first quarter of the twentieth century imposed somewhat of a problem in order to supply electrical energy to the pit portable equipment. Strip mining using electric shovels, draglines, excavators, etc., has required the use of portable electrical power systems to keep up with the portable equipment as it strips out a given area. Originally, copper overhead three-phase, three-wire transmission lines from the public utility transformer substation supplied electrical energy to the area to be stripped. From the overhead line, rubber insulated shovel trailing cables for each piece of equipment were attached by means of an oil circuit breaker or fuse disconnect switches at required intervals. This type of power system did not afford maximum protection to personnel and equipment, resulting in many fatal accidents from electrocution and serious fires to equipment.

To overcome this serious problem, the first attempt in the mining industry was to use type G portable shovel cables with ground wires built into the cable and the installation of a fourth wire to the overhead transmission lines. This installation permitted the connecting of the pit portable equipment frames through trailing cable to earth grounds along the overhead transmission system. Providing the transformer windings were connected wye as used on a 4160-volt system, the ground circuit was frequently connected to the transformer secondary neutral. Installation failures or ground faults to this system resulted in ground fault current flowing of extreme high magnitude limited only by the resistance and impedance of the circuit. Consequently, when a ground fault occurred, the equipment frame was at a very high potential above earth during the time the fault existed.

Protection Against Ground Faults

By 1935 many of the strip mining companies had adopted the practice of installing a neutral ground fault current limiting resistor. The installation of this resistor is still common practice and is connected in the ground circuit near the transformer secondary neutral. The power system is de-energized from the substation when a ground fault occurs indirectly by a current transformer.

On a 4160 volt wye, 3-phase, 4-wire system, when using 48-ohms neutral ground resistor, the ground fault current is limited to approximately 50 amp. The portable frame potential above earth is thus limited to a maximum of 100 volts, providing there is a continuity of the ground system. It is assumed that 100 volts between equipment frame and earth is a safe value to personnel. Seldom, if ever, is this maximum of 100 volts reached when a ground fault occurs on the system.

With transformer secondary winding connected delta, it is first necessary to establish a neutral. The neutral may be established by installing three single-phase transformers with their primary winding connected wye across the delta system or the use of a zig-zag transformer. An over-current relay may then be installed to interrupt the circuit upon occurrence of an electrical fault when the ground fault current exceeds a predetermined value. This type of installation is a system adopted by the mining industry today. It is a system that conforms to the grounding of portable equipment when the voltage exceeds 150 volts as set out by the Federal Mine Safety Code for Bituminous Coal and Lignite Mines of the United States for Strip Mines, dated October 8, 1953.

Heavy Equipment Adds Power Problems

Portable strip mine equipment has increased in size immensely in the past 30 years and, therefore, the requirements from the electrical power system has had to expand proportionally. In many instances the application of portable cables (1000 ft lengths or more) connected together have been installed, replacing the high line. Such a system affords better voltage regulation at the equipment than an overhead line using the same size copper conductor. In other words, a portable power system using cables permit the operation of equipment a greater distance from the source of power than when overhead lines were used.

Public utility companies supplying the electrical energy for the operation of strip mine portable equipment are faced with the problem of greatly increased capacity required from their system. In many instances they have been able to take care of this increased capacity by changing to higher voltage transmission lines. For large power users a more favor-

able power contract with the utility companies is available, providing it is received at the higher voltage. This necessitates the purchasing by the user of the transformer substation, stepping down the voltage from the relative higher voltage to the voltage required for the portable equipment.

In many instances energy is now normally received at 33,000 or 66,000 volts. The energy consumed is normally metered at this higher voltage. Thus the user builds the higher voltage transmission lines from the metering station to the portable substation units located in the proximity of the area to be stripped. The portable power systems at four of Ayrshire Collieries Corporation's, or its subsidiary's, strip mines are presented for discussion.

Chinook Mine

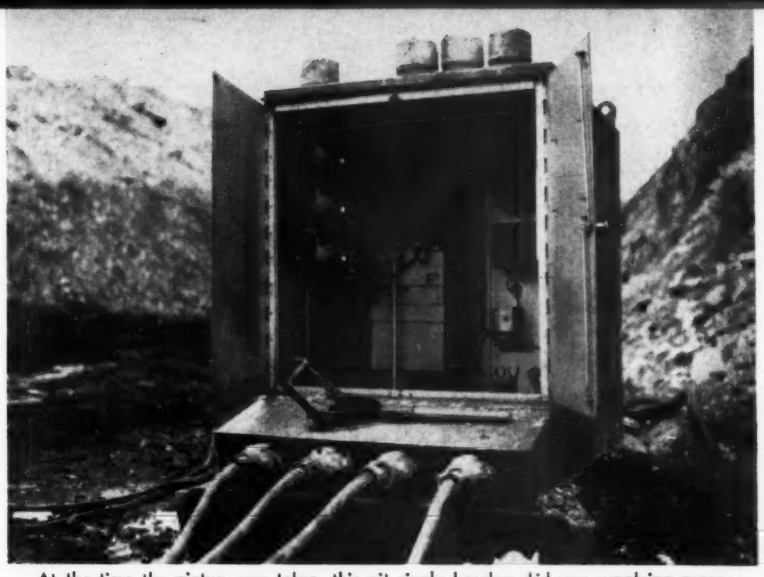
First let us discuss the portable power distribution system at our Chinook mine near Brazil, Ind. Power is received at 33,000 volts and is stepped down to 4160 volts wye by a 1500-kva, three-phase substation unit. From the substation, four-kv power is transmitted over 2/0 overhead lines to the strip area. At various intervals along the overhead transmission line, 2/0 type SH-D portable cable connect the hill breaker skids to the line by means of disconnect switches. From these skids, shovel trailing cables, type SH-D, are connected to the various pieces of equipment. The cables are connected to the skids by means of single conductor 5000-volt push-pull neoplene insulated plugs and sockets.

Type SH-D portable cables are used exclusively due to the design and safety advantages. This round type cable has a copper sheath over the individual conductors and ground wires in the interstices. It is the type cable recommended for use with high voltage shovels and other equipment for maximum protection to cables and personnel. On portable cables which the mine purchases, one of the ground wires in the interstices is insulated for 600 volts. This insulated ground conductor is used to test the continuity of the ground circuit.

The 1500-kva substation unit supplies power for the following equipment:

1050-B Bucyrus-Erie Co. ..... 36 cu yd, stripping shovel
4161 Marion Power Shovel Co. ...8 cu yd, coal loader
9-W Bucyrus-Erie Co. .....12 cu yd, booster dragline
50-R Bucyrus-Erie Co. ...overburden drill
Four 112-kva pit portable substations.

The pit connected a-c motor nameplate load at this mine is approximately 2570 hp, exclusive of the 440-volt a-c motors operating from the pit substations. The power distribution at this mine has proven entirely satisfactory and has given satisfactory voltage regulation at the equipment when the maximum distance has not exceeded 8000 ft from the substation. The 15-minute maximum demand has been 1150 kw. The instantaneous peak demand has been 2500 kva.



At the time the picture was taken, this pit single breaker skid was supplying power to two 190-B shovels, one rock drill and one pit portable substation unit. Note the handle for engaging and disengaging the plug into the socket

The single circuit automatic substation unit includes a three-phase oil filled transformer rated 1500 kva, 33,000 volt primary, 2400/4160 volt secondary. Two 2½ percent taps plus and minus are supplied on the primary winding. The high voltage bushings for overhead line connection from the 33,000-volt line are mounted on supports on the transformer tank cover and the high voltage lightning arresters are mounted on supports on the transformer cooling tubes. High voltage fuses are supported between the tops of the high voltage bushings and the high voltage lightning arresters. A magne-blast circuit breaker is provided for the low voltage feeder circuit and is operated by a solenoid mechanism.

The circuit breaker terminals are connected to the transformer low voltage bushings and to the low voltage line buses. The power transformer neutral lead is carried through two bushings in the roof of the substation unit control breaker compartment to the neutral ground fault current limiting resistor. A current transformer for supplying current to the ground over-current relay is located in one of these neutral leads. The circuit breaker operating equipment consists of a solenoid operated closing mechanism, the three current trip coils, one potential trip coil, cut-off switch and auxiliary switches all mounted as a unit.

The power control panel is located in one of the compartments of the substation unit. On this panel are mounted three time over-current relays and a ground over-current relay. Near the top of the breaker are mounted ammeter and voltmeter for reading the current and voltage on the low voltage lines. Transfer switches are also located on the panel connecting the two meters into any one of the three phases.

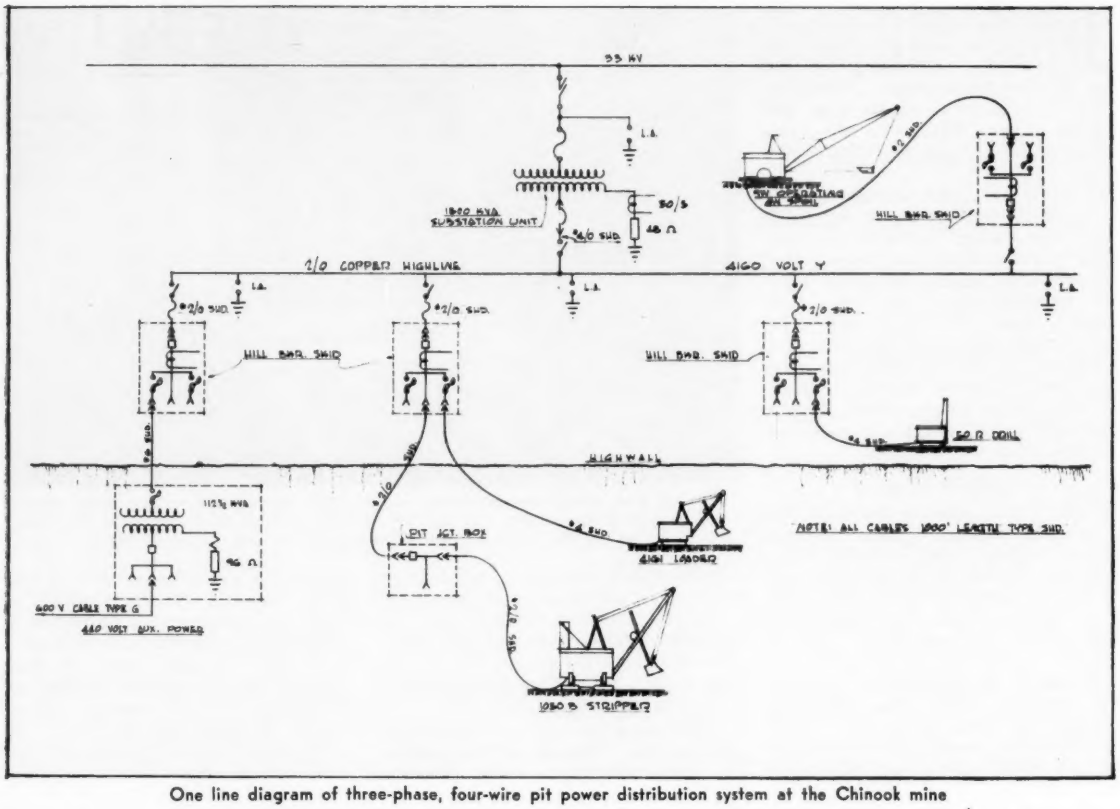
To guard against contact with the substation buses in the rear compartment where the portable cables are attached while the transformer is energized, a key interlock is provided between the door of the cable compartment and the low voltage circuit breaker. The key cannot be removed from the lock at the circuit breaker with the breaker closed and you cannot enter the cable compartment without the key. Neither can the circuit breaker be closed until the cable compartment door has been closed and the key inserted at the circuit breaker.

Harmattan Mine

At our Harmattan mine two 1500-kva substation units are required. One supplies power for the 1250-B pit and the other one for the 1150-B pit. Hill breaker skids are used to connect 1000 ft lengths of 4/0 type SH-D portable shovel cable together. Either dragline operates satisfactorily a maximum distance of 6000 ft from the substation unit. The 4121 coal loading shovel is moved from one pit to another. The equipment at this mine consists of:

1250-B Bucyrus-Erie Co. ..... 30 cu yd, dragline
1150-B Bucyrus-Erie Co. ..... 25 cu yd, dragline
4121 Marion Power Shovel Co. 7½ cu yd, coal loader
Five 75-kva pit substation units.

The pit a-c motor nameplate load at this mine is approximately 4086 hp, exclusive of the 440-volt a-c motors operating from the pit substa-



One line diagram of three-phase, four-wire pit power distribution system at the Chinook mine

tions. The combined pit power requirements are: 15-minute maximum demand, 2450 kva, and instantaneous maximum peak demand, approximately 4050 kva. The connected a-c motor nameplate load for the 1250-B pit is 2270 hp, exclusive of the 440-volt a-c motors operating from the pit substation units.

Actual operating conditions were observed for the 1250-B pit, at which time the 4121 shovel was loading coal and the 1250-B dragline was operating 3000 ft from the substation. The maximum voltage drop between substation unit and the 1250-B dragline was found to be 4.38 percent—at the time the substation was delivering 3000 kva to the system. The mine had been able to operate the 1250-B dragline or 1150-B dragline a distance of 6000 ft from the substation unit with less than a ten percent voltage drop.

The entire portable power system at this mine is by cables, multi-conductor, 5000-volt plugs and sockets. The cables connecting two skids together have plugs on both ends. The plugs are installed in such a manner that it does not make any difference which end of the cable is connected to the skid. The same rotation of the equipment's a-c motors are accomplished by rotating two of three-phase conductors in one of the plugs at the time of its installation.

Wright Mine

The Wright mine has two substation units, 1500/1725 kva capacity. One of these units is considered as a spare but actually is in operation supplying power to the equipment as it approaches its proximity. All cables are 4/0 type SH-D of 1000 ft lengths unless otherwise noted in the accompanying one line diagram of Wright's pit power distribution system. All skids and cables have multi-conductor sockets and plugs. The single breaker pit skids supply power to the pit load. The 50 R overburden drill which operates on the high wall is connected by its own trailing cables to one of many of the two breaker hill skids. The equipment at this mine consists of:

5561-M Marion Power Shovel Co. ..... 45 cu yd, stripping shovel

4161-M Marion Power Shovel Co. ..... 8 cu yd, coal loader

50-R Bucyrus-Erie Co. overburden drill

Four 112½-kva portable pit substations

The total pit a-c nameplate load at this mine is approximately 2280 hp, exclusive of the 440-volt a-c motors connected to the pit substation. The pit 15-minute demand is 1320 kva and the instantaneous peak maximum demand is 2700 kva. Actual operating conditions were observed with the 5561 shovel operating 4000 ft from the substation unit and the rest of the equipment in operation. The results showed the voltage drop only 2.3 percent at the 5561 shovel in relation to the voltage at the substation at instantaneous maximum peak loads.

The single circuit intregal substation at this mine is essentially identical to that at the Chinook and Harmattan mines except for the following: the three phase transformer primary is rated 33,000 by 66,000 volts. The substation unit is energized at 66,000 volts. In case the substation unit is operated at 33,000 volts, the lower half of the lightning arresters are shorted and connected to the ground. The transformer is also provided with a terminal board submerged beneath the oil and accessible through a man hole on the cover for connecting the high voltage winding either in series for 66,000 volts or in parallel for 33,000 volts. The connections are only changed with excitation off the transformer.

Provisions have been made for future installation of fans to provide forced air cooling of the substation.

Gibraltar Mine

At the Gibraltar mine, the power distribution system consists of three 1500/1725 kva substation units connected in parallel. At the present time only two units are operating in parallel. The third substation unit

is on order and will be connected parallel with the other two when it is installed. The pit power distribution system is entirely by portable cables and multi-conductor plugs and sockets.

Special mine power cables are used between the three breaker skids. The cable is similar to the portable shovel cable, type SH-D, in construction as it does have a copper basket weave over the individual conductors. It has smaller ground conductors and reduced thickness of the outer jacket and was purchased at a saving of approximately 46 percent. This less costly cable was purchased at this mine for exclusive use on the high wall. It is not intended to be used in the pit; neither is it intended to be used between the hill three breaker skids and the pit skids. Seldom, if ever, will it be necessary to move the special mine power cable while it is energized. The more expensive power shovel cables which are more flexible and have thicker installation are used exclusively between the hill three breaker skids and the portable equipment.

The portable equipment consists of the following:

5561 Marion Power Shovel Co. . . 42 cu yd, stripping shovel
7400 Marion Power Shovel Co. . . 13 cu yd, dragline
151-M Marion Power Shovel Co. 10 cu yd, coal loader
190-B Bucyrus-Erie Co. . . . . . 10 cu yd, high lift coal loader
190-B Bucyrus-Erie Co. . . . . . 6 cu yd, high lift rock shovel
50-R Bucyrus-Erie Co. . . overburden drill
Two shop made rock drills.
Six 75-kva, three-phase, portable pit substation units.

The connected a-c motor nameplate load for the pit power distribution system is approximately 5270 hp, exclusive of the a-c motors connected to the pit substation units. The 15-minute maximum demand is 2870 kw at 95 percent power factor, and the instantaneous peak demand is 5400 kva.

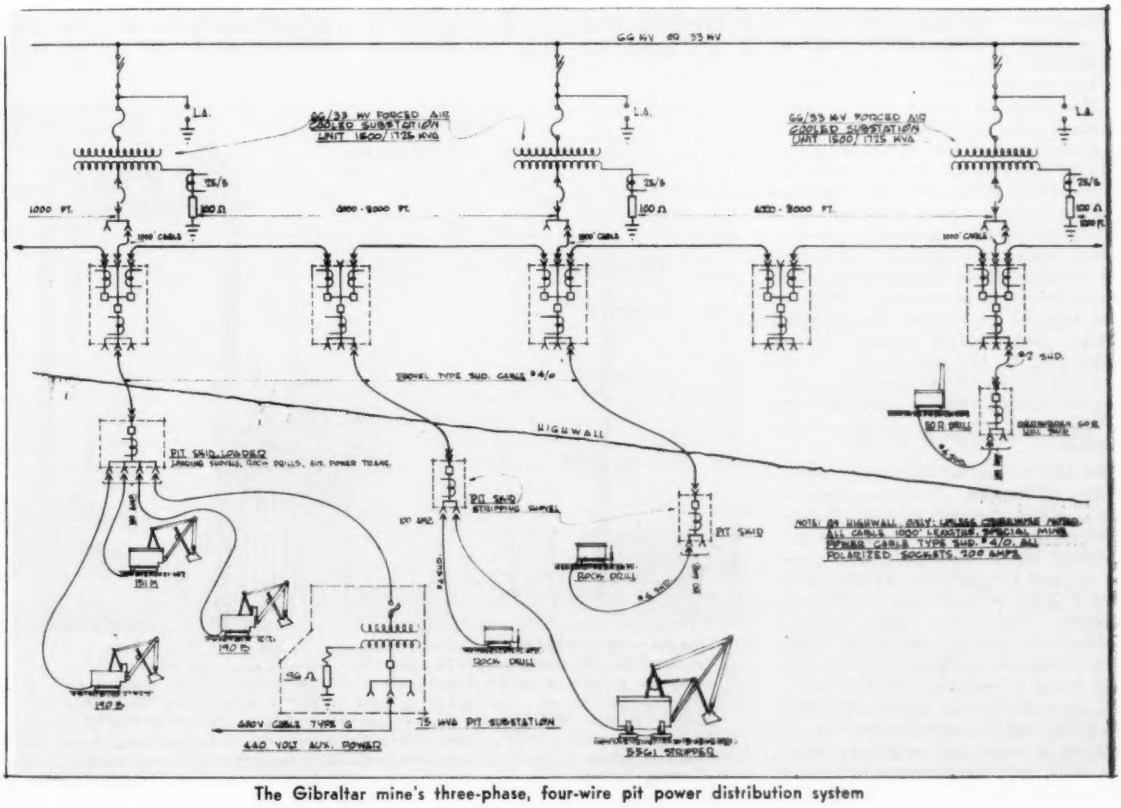
Under actual operating conditions at which time the demand was 5400 kva, the voltage drop between the 5561 shovel and the substation unit was only 5.53 percent. At the time the voltage readings were recorded, the 5561 shovel was connected to the second hill three breaker skid from the substation unit on the left and from the third hill three breaker skid from the substation unit on the right. The distance from the 5561 shovel to the substation on the left was 4000 ft and 5000 ft to the substation on the right.

The single circuit substation units at this mine are similar in design to those of the units at the Wright mine, but their capacity has been increased by 15 percent by the addition of forced air cooling. Single circuit substation units of a capacity of 1725 kva were selected and connected in parallel for several reasons rather than single circuit substation unit of a capacity capable of supplying power for the entire load.

Transformers of the capacity selected for paralleling are of standard design. We have ten in operation and still another one, our portion of one in a spare parts pool. The 4/0 power cable, the multi-conductor cable plug and socket and the 1500/1725 kva substation unit are theoretically of the same thermal capacity; therefore, their use together form an ideal combination. At this mine 4/0 portable power cable is of sufficient size to operate the largest piece of equipment. The 1500/1725 kva portable substation units, mounted on skids, are easily moved by means of tractor from one location to another. For long pit operations, paralleling of these substation units permit us to operate equipment, which at this mine consists of many pieces of equipment, a greater distance than it would be possible if one single substation unit of the required capacity were used.

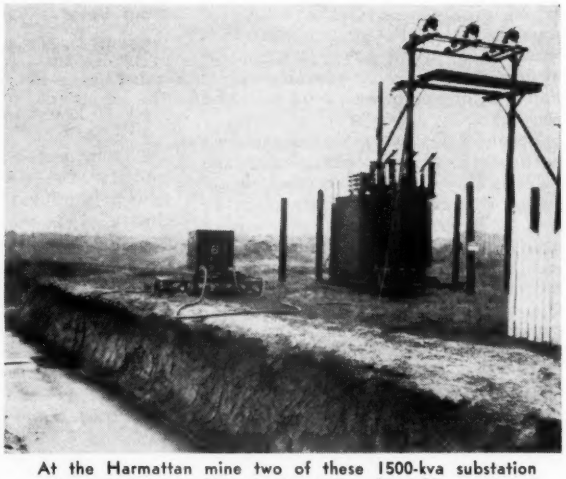
The theoretical ideal conditions for paralleling the three-phase transformers are:

1. Same phase rotation.
2. Same phase angle shift.
3. Same polarity.



The Gibraltar mine's three-phase, four-wire pit power distribution system

This single circuit substation unit at the Gibraltar mine is connected to the high line through a gang operated disconnecting switch. The switch is mounted on a steel structure which as a unit is portable



At the Harmattan mine two of these 1500-kva substation units are required. Note in the picture the cable connected between hill breaker skid and the substation unit, and the cable from the hill breaker skid supplying power to the pit

4. Identical turn ratios and voltage ratings.

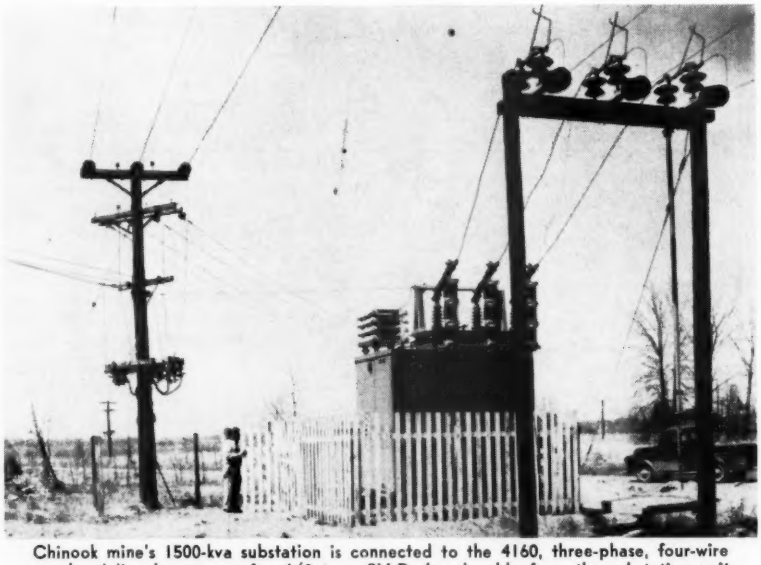
5. Equal percent impedances.

6. Equal ratios of resistance to reactance.

The three single circuit substation units at this mine are identical; consequently, the last five items mentioned above are automatically taken care of, providing the no-load tap changers are set alike. In order to parallel the operation of two or more substation units, phase rotation must be the same. Phase rotation refers to the order in which the terminal voltages reach their maximum values. In paralleling, those terminals whose voltage maximum occur simultaneously are in phase and are connected together by the circuit breaker. Each substation unit is equipped with necessary equipment that will not permit the breaker to be closed paralleling two substations unless the voltage on both sides of the breaker are the same phase. Added safety features are incorporated within the substation design to indicate to the operator of the substation unit voltage level and load at all times on both sides of the breaker.

At the Gibraltar mine the single circuit substation unit is connected to the high line through a gang operated disconnecting switch. This switch is mounted on a steel structure which as a unit is portable and may be moved readily from one location to another. The cross pipe member directly supporting the three single pole disconnect switches may be lowered from a maximum height of 18 ft approximately six ft, thus lowering the center of gravity of the unit and making it safer and easier to move. The disconnecting switches can easily be lowered in a matter of a few minutes by using a mobile crane which is available at this mine. The upright pipe members are welded to the pipe frame skid. The pipe skid runners are parallel to the members supporting the disconnects and are spaced 10½ ft center to center. The steel structure is connected to earth by copper conductors in drill holes which extend through the lower seam of coal. The resistance to ground is maintained below two ohms.

The gang operating disconnecting switches are connected with number two solid copper wire (slack spans) to the high line and to the substation unit. For simplicity of connecting, the high line is dead ended in a vertical plane. The disconnecting switches are located as near as possible to the high line and to the substation. The complete assembly substation unit and disconnecting switches may be disconnected and moved to a new location and reconnected in a few hours. This arrangement of portable equip-



Chinook mine's 1500-kva substation is connected to the 4160, three-phase, four-wire overhead line by means of a 4/0 type SH-D shovel cable from the substation unit along the ground up to the disconnecting switches located on the pole to the left of the substation unit. The neutral ground resistor is mounted on top of the substation. Its ground connection is overhead to the pole to the left of the substation. At the top of the pole it is connected to the fourth wire of the overhead line. The 4160-volt system is grounded approximately 150 ft from the substation unit so as to eliminate the possibility of a fault on the 33,000-volt system getting into the 4160-volt system

ment has reduced the down time and labor cost of the relocating of the substation unit.

The neutral ground resistor at each substation unit limits the transformer maximum neutral ground fault current to 25 amp. Two substation units operating in parallel permit a system maximum ground fault current of 50 amp.; likewise, three substation units operating in parallel permit 75 amp.

All breaker skids are provided with overload protection and over-current ground fault protection. When a ground fault occurs on any of the equipment or its cable, its respective skid breaker is de-energized instantly. Should the equipment skid breaker fail to open, the load breaker within the hill three breaker skid will trip. The breaker in the substation units serve as the final back-up protection.

One of the apparent advantages of the multiple substation system lies in the fact that with suitable relaying, it is possible to isolate faulted sections of the hill cable without interrupting service to any part of the stripping operations. Suitable relaying, however, considering the number of radial load taps in a hill cable, to provide isolation for all types of faults represents an investment of considerable magnitude. Fortunately, the majority of faults in a cable circuit occur from phase to ground due to the physical configuration of the SH-D type of cable construction. Therefore, a relatively high degree of protection is afforded by relaying only ground faults to remove faulted cable sections from the system.

A simple, inexpensive ground directional relaying scheme has been incorporated in the hill three breaker cable skids used at each load tap in the hill cable. The scheme in effect is a simple pilot wire differential arrangement, using insulated control conductor as one of the pilot wires and the cable ground conductors as the other. Only the relays associated with the breakers at each end of a faulted hill cable section respond to ground fault currents within the section, to remove it from the system.

With a source of power on each side of the grounded section, it can be removed from the system without seriously disrupting service to the other operations in the pit.

Conclusion

One should not obtain a false impression from the parallel versus single transformer portable power distributing systems. Two half-size transformers operating in parallel side by side would not have the advantages over one full size one. The advantages appear only when a large physical distance between them exists. Considerable valuable information may be obtained by comparing portable power distribution systems utilizing two substation units connected in parallel versus one single substation unit, but double the capacity.

Our analyses, in the author's opinion, have proven conclusively the advantages of parallel operation of transformers for portable power distribution systems for strip mines. The advantages become more pronounced as the equipment increases in size. One advantage well worth mentioning is the possibility of continuation of operation at reduced capacity while one transformer is out of service. Forced air cooling of the smaller transformers operating in parallel is highly recommended.

After one year of operation, our experience in paralleling transformers for portable power has convinced us that the many advantages far outweigh the few disadvantages. Many similar power distribution systems undoubtedly will be installed as equipment increases in size and pit operations increase in length.

Portable Power Systems for Strip Mines

A DISCUSSION

By B. E. RECTOR
Westinghouse Electric Corp.

L. E. BRISCOE's article indicates a great deal of worthwhile thinking and planning went into establishing the distribution systems for the mines which he has covered. The description of operation demonstrates that the planning and engineering given these systems has paid off in the excellent results obtained from them.

In the layout of distribution systems there are three primary factors involved. The system must be capable of supplying the load equipment without objectionable voltage regulation from an operating standpoint and at the same time stay within reasonable economic limits. Second, the system must provide adequate standards of safety to both personnel and equipment. Third, the units comprising the system must be adaptable to relocation in order to keep up with the change in load requirements. The systems described amply meet these conditions.

The voltage regulation values which Briscoe has observed in his various mines indicate that the voltage values at the machines are better than those usually encountered. The unitized substation arrangement adequately meets the requirement of portability where frequent relocation of the substation is necessary. In those cases where the substations remain fixed for relatively long periods of time the difference in first cost of portable versus stationary units must be analyzed and weighed against the costs of moving each type equipment.

Ground Protective System

It is interesting to note that the general ground protective system which Briscoe has utilized is the one which practically all open pit operations are adopting. In many instances the value of a protective grounding system has demonstrated its desirability not only for personnel protection but for equipment protection also. Primary considerations involved in the selection of a protective grounding system include:

(1) **The maximum value of machine frame to ground voltage during a ground fault.**

(2) **The magnitude of fault impedance that can be relayed.**
(3) **Provisions for checking or monitoring continuity of the ground wire circuit.**
(4) **Establishment of a protective ground separate from the substation ground.**
(5) **Proper choice and rating of components to maintain low frame to ground voltage in event of failure to trip on a ground fault.**
(6) **Immediate isolation of a faulted feeder from the remainder of the system.**

The importance of a ground current limiting resistor has been recognized and its use is now common practice. Based on the arbitrary decision that the maximum machine frame to ground voltage during a ground fault condition should be 100 volts or less, the grounding resistor value should be selected to meet this requirement. The frame to ground voltage that is developed under fault conditions is approximately the ground current times the impedance of the ground wire. This is the potential to which personnel standing on the ground touching the frame of the machine would be subjected upon the occurrence of a ground fault on the system.

For example, in a system using a resistor limiting ground fault current to 25 amp where the ground wire impedance in the cable is two ohms, the machine frame to ground voltage would be 50 volts. For a system using 50-amp ground current limit and a two-ohm impedance in the ground wire, the voltage would be 100 volts. In the case of more than one substation, each having its own ground current limiting resistor to limit individual substation ground currents to 25 amp, paralleling would permit a total of 50 amp to flow in the ground wire in case of a solid phase to frame fault and would result in a total drop in the ground wire of 50 amp $\times$ 2 ohms or 100 volts. In the instance of each substation having its own 50-amp ground current limiting resistor, the frame to ground voltage would be 100 $\times$ 2 ohms or 200 volts. If more than two similar substations, each with its own ground current limiting resistor, are used, the total ground current that would flow in the cable ground conductors would be the sum of the currents for all substations.

The grounding resistor will establish the maximum value of ground current that can flow under solid fault conditions. The value at which tripping should occur in order to isolate a faulted feeder should be considerably below this point. The ratio of limit value to ground relay pick-up value determines the value of fault resistance that can exist and still obtain tripping. The higher this ratio

The advantages of parallel operation of transformers for portable power distribution systems for strip mines become more pronounced as the equipment increases in size

the greater the fault resistance can be for relay pickup. Once a high resistance fault occurs, it is improbable that such a fault will clear, so its immediate isolation is advantageous. Hence the ability to relay a high resistance fault is important in safety grounding systems.

For instance, one recommended scheme uses a 25-amp ground current limiting resistor and a ground detecting transformer and relay combination set to trip at five-amp fault current. On a 4160-volt system this resistor value would be 96 ohms. In a 4160-volt resistance grounding system, the line to neutral voltage is 2400 volts. Thus a total resistance (grounding resistor plus ground wire resistance plus fault resistance) of 480 ohms $\left(\frac{2400}{5} = 480 \text{ ohms}\right)$ could be permitted and still obtain five amp in the ground circuit. Subtracting the 96 ohms of the resistor from the 480 ohms would permit approximately 384 ohms to exist in the fault. Thus, fault resistance between 380 ohms and 0 ohms could be relayed.

Safe Ground Conductors

The successful operation of the safety grounding circuit is dependent on the ground conductors from the machine frame back to the substation being intact. If the ground wire is broken or an open terminal connection develops, the effectiveness of the circuit and hence the protection it affords is seriously impaired. Various methods of checking ground wire continuity have been used.

In some instances a ground wire check is made at the beginning of a shift. This consists primarily of imposing an artificial ground fault on the unit and noting tripping of the feeder breaker. Recently, schemes have been used to provide continuous monitoring of the ground wire circuit. In some cases an alarm is sounded on the equipment indicating to personnel that the ground circuit is not intact. Other schemes have been used to actually trip the supply breaker in case the ground circuit is interrupted. These latter two systems require either a pilot wire in the cable or insulation of one of the grounding wires from the remaining ground wires.

To minimize the rise of potential above earth of the protective ground wire and the frames of any mobile machines to which it is connected during lightning arrester discharges, or in case of flashover of any of the substation apparatus, the substation protective grounding resistor should be connected to a ground separately constructed and not interconnected with the main substation ground. This protective ground should have as low a resistance as possible (preferably under five ohms) and should be located some distance away from the main substation ground in order to minimize any unsafe rise of potential of the protective ground system at the times heavy fault currents may be flowing into the main ground. Depending upon the ease with which this protective ground point can be located, the distance from the main substation ground is found to be usually 50 to 200 ft away.

As compared to the usual practice elsewhere in the electrical industry wherein grounding equipment is given a short-time rating, the protective grounding equipment components for portable mining equipment should be continuously rated for the maximum current limit value chosen. The reason for this rating is that the equipment should be capable of withstanding the continuous ground fault current for which it is designed in case a component such as a breaker or relay should fail to function. Failure of the grounding resistor of ground-

ing transformer would result in loss of protection.

Since one of the main purposes of the grounding system is to isolate a faulty feeder as quickly as possible, ground fault tripping on the breaker unit nearest the load should be made instantaneous. If there are other breaker units between the load and the supply substation, these units should be set for the same value of ground current as the unit nearest the load, but provide selective tripping on a time basis.

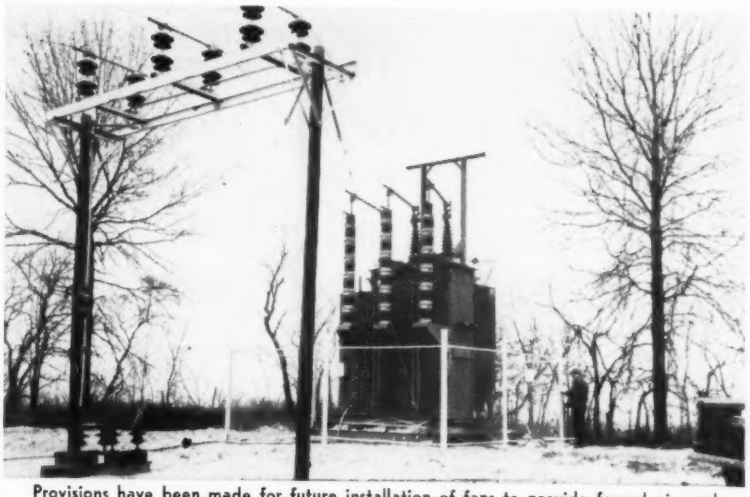
In those operations using 480-volt auxiliary pit equipment, this voltage is usually obtained by means of a separate transformer supplied from a junction point in the high voltage distribution cable. Even on this comparatively low voltage portion of the system, safety ground fault protection is receiving increased attention. The low voltage secondary side of this transformer has its own grounding resistor and relaying system so that ground faults can be detected and isolated, thus providing similar protection to personnel and equipment as on the high voltage system.

Trend Toward Higher Voltages

With the advent of increased horsepower on single excavator units, it appears the natural trend will be toward higher utilization voltages. One operation has interspersed 7200 volts with its 4160-volt system. This operation is supplied by a 132-kv power company feed and the power is transformed from 132 kv to 69 kv for primary transmission around the property. Metering at this substation is on the 69 kv side. In addition to the 132-kv supply there is an alternate supply at 69 kv. The 69 kv is distributed around the property in a loop system. Sectionalizing points are established around this loop. The 69 kv is carried on single pole construction with one static wire above the phase wires.

Power to the individual mining units is by means of individual substations tapped from the pole line. These substations transform the voltage from 69 kv to 4160 volts and all 4160-volt power is carried in cables on the ground. Maximum cable lengths of 15,000 ft have been used; however, the average cable reach is approximately 10,000 ft. Cable sectionalizing for auxiliary 4160-volt pit power is accomplished by sectionalizing boxes employing disconnect switches. The boxes are also used to facilitate adding and removing cable sections. Type SH-D trailing cable is used up to a distance of 2000 to 3000 ft away from the machine. From the substation to this point mine power cable is utilized.

Basically, the individual pit substations are 1500-kva units. These substations could be termed semi-portable and consist of a two-pole structure tapping the incoming 69-kv open wire line. On the structure are mounted gang disconnect switches and power fuses. The fuses are connected to the transformer primary bushings and the secondary bushings are wired to a separate skid mounted switch unit. The current limiting resistor is mounted on the circuit breaker skid. Since these substations remain fixed for a relatively long period of time, this type construction has proven satisfactory and economical.



Provisions have been made for future installation of fans to provide forced air cooling of the Wright mine's substation

In conclusion, with the increased load demands of higher powered machines, a great deal of planning and thought must go into the distribution systems supplying power to these units. Consideration must be given to continuity of operation, adequate voltage, protection to both personnel and machinery, as well as ease of relocation of distribution system components in those cases where this is a factor.

With the advent of increased horsepower on single excavator units, it appears the natural trend will be toward higher utilization voltages

Operating Experience With Steel Cable-Supported Conveyors

International Minerals & Chemical Corp. operates one of six potash mines in New Mexico which together produced about 92 percent of the total U. S. production in 1956

By E. C. SKINNER
Manager, Potash Division
International Minerals & Chemical Corp.

THIS article will describe the use of rope suspended conveyor belts in the production of langbeinite ore at the mine of International Minerals & Chemical Corp., located east of Carlsbad in southeastern New Mexico. Use of the belt has made possible significant improvement in per manshift production of this ore.

International operates one of six mines in the potash basin which together produced more than 3⅓ million tons of potassium salts in 1956. This amounts to 92 percent of the total United States production. A seventh mine is now being developed in the area.

The potash beds are found in the upper part of the great Salado evaporite formation of Permian age. The deposition was very complex and there is evidence of numerous cycles of refreshment and evaporation over many hundreds of ft. It consists chiefly of halite beds separated by beds or bands of polyhalite and anhydrite; its maximum thickness is nearly 4000 ft. The dip of the entire formation is about 60 ft per mile to the southeast. Through a 250-ft interval near the top of the formation are found several thin beds rich in potash bearing minerals, chiefly sylvite — potassium chloride — and less frequently, langbeinite — potassium magnesium sulphate. All of the beds grade abruptly to halite, both above and below, but the lateral transition generally is more gradual. However, barren masses of halite called "Salt Horses" occur irregularly throughout all beds.

Coal Mining Methods Employed

At International's mine, two of these potash beds are being mined. The No. 4 bed—U. S. G. S., First Ore Zone—is the lowermost commercial ore bed in the series and at our mine lies about 900 ft below the surface. It consists chiefly of sylvite and halite and is the source of International's sylvite production.

Four other producers mine sylvite from this horizon also. The bed ranges in thickness from five to ten ft. It is generally flat lying, but may exhibit occasional local rolls or dips of as much as five percent.

International employs conventional mining methods similar to those used in coal. The ore is cut with Universal undercutters; drilled with two-boom jumbos; blasted with milli-second delay electric blasting; and then loaded into shuttle cars with gathering arm loaders. Shuttle cars discharge directly into 42-in. gauge rotary dump rail cars of approximately 6½-ton capacity.

The sylvite ore accounts for approximately 80 percent of International's mine tonnage. The remainder consists of langbeinite ore. Langbeinite, a double sulphate salt of potassium and magnesium is found in the No. 3 bed—U. S. G. S. Fourth Ore Zone—and lies about 50 ft above the 900-ft level sylvite bed.

Langbeinite ore is both harder and

Reduce haulage costs or lose valuable reserves. That was the problem faced by this potash mine. The solution is given in this report which describes the operation and discusses the reasons why rope supported conveyors were considered for a special application

E. C. Skinner is a graduate of Lafayette College, Easton, Pa. His experience includes ten years with the Pittsburgh Coal Co., Pittsburgh, Pa., where he engaged in a variety of work including methods and industrial engineering as well as mine supervision. For a period of six years he was employed at the Ford Collieries Co. at Curtisville, Pa., as resident mining engineer. In 1953 Skinner joined International Minerals & Chemical Corp., in Carlsbad, N. M., as industrial engineer and is now resident manager of the mine and plant at Carlsbad.

heavier than sylvite, but is mined with similar equipment, except that there is no rail haulage on the 850-ft level.

A room and pillar mining system is used with 36-ft wide rooms and break-throughs and 33-ft square pillars. The mining height averages about 6½ ft. Ore is drilled with Joy CD-42 double boom jumbos, modified in our own shops for one-man operation. Tungsten carbide insert bits on 11-ft-long auger drill steels are used. Undercutting is done with a Universal undercutter equipped with a ten-ft cutter bar. Rounds are fired with milli-second delay electric blasting. Joy 30BU and 11BU loaders load the broken ore into Joy 60E15 shuttle cars which are equipped with both trailing cables and trolley poles.

There is no rail haulage on the 850-ft level and up until January of this year the combination cable-trolley shuttle cars hauled the broken ore directly to raises driven from the 850-ft to the 900-ft level below. The ore is drawn off on the sylvite level into rail transportation for haulage to the dump at No. 1 shaft.

Haulage Costs Increase

As long as the langbeinite level was operating directly over open mine workings on the 900-ft level there was no problem in finding adequate raise sites and langbeinite shuttle car hauls were kept to a minimum. But in recent years, as langbeinite operations progressed beyond the fringes of economic sylvite mining below, the problem of finding suitable raise sites has become increasingly difficult and the shuttle car hauls on the langbeinite level, which originally had been planned for a maximum 1000 ft, often extended as far as 1500 ft. As would be expected, such long shuttle car hauls made it necessary to put a greater number of cars in service and unnecessarily increased mining costs. It also became evident that because of the increased haulage costs, much valuable ore would have to be left unmined. Obviously, something had to be done to reduce langbeinite haulage costs and to make certain that an appreciable portion of the langbeinite reserve would not be lost to mining for this reason.

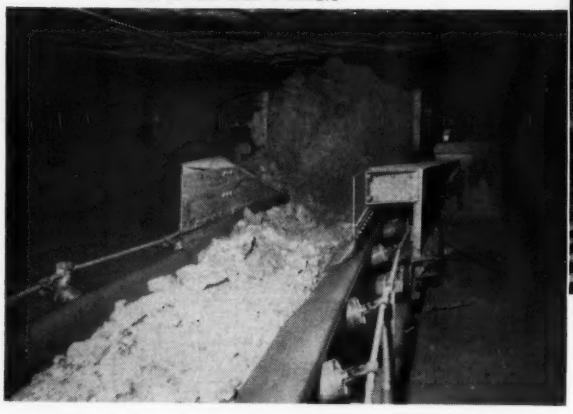
One of the solutions investigated was a conveyor belt. Prior to this year, International had only one conveyor belt underground. It is a heavy, permanent installation hauling crushed sylvite ore up a 14° slope from the No. 2 dump to the ore hoisting shaft about 1000 ft away. Belts had been investigated for run of mine production before, but management felt the conveyors of standard construction sacrificed some of the desirable flexibility in the mine operations and furthermore, they seemed to be suited for use with crushed material only. In order for us to utilize such a belt in our operation, it would have been necessary to install a crusher at or near the belt loading point to reduce large lumps of raw ore to a size that could be conveyed without damage to the equipment. This would, of course, entail the added expense of crushing equipment, in addition to that of a conveyor and because of the size and the complexity of such an installation, it would be difficult and costly to move up so as to keep pace with mining advance. Because of the low seam height it would undoubtedly be necessary to almost totally dismantle the crusher to make such a move. This inflexibility, together with the high cost for such installations, made the proposal economically unattractive.

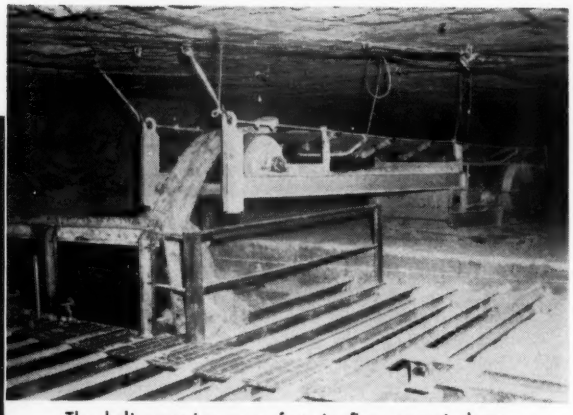
Why Rope Supported Conveyors Were Considered

Finally, however, management decided to investigate the newly developed rope supported belt and it was immediately apparent that this new idea in conveyor construction offered promise of a solution to our langbeinite haulage problems. The rope belt was developed by the Goodman Manufacturing Co., and consists of two parallel wire ropes independently supported and tensioned at intervals along the length of the belt. Linked carrying idlers and spreader bars suspended between the ropes carry the top flight of the conveyor. Floor stands provide intermediate support for the rope between anchor points and also support the return idlers upon which the return flight of the belt is carried. Rigid structural support for the carrying idlers is completely absent. The head and tail

Conventional mining methods similar to those used in coal are employed. The ore is cut with universal undercutters, drilled with two-boom jumbos, blasted with milli-second delay electric blasting and then loaded into shuttle cars with gathering arm loaders

Belt tail section is designed to accommodate the six ft wide shuttle car discharge over the end or from either side. The shuttle car deposits its load on the belt in less than a minute





The belt operates on a four to five percent downgrade to the raise and travels 350 fpm. It is extended about every six weeks, with total labor for extension amounting to 1/3 man-hour per ft

sections are mechanically very similar to those on conventional belts except that the rope tension feature makes it possible to eliminate the conventional belt take up system. The simplicity of the design makes it possible to assemble the components into a working conveyor belt in minimum time.

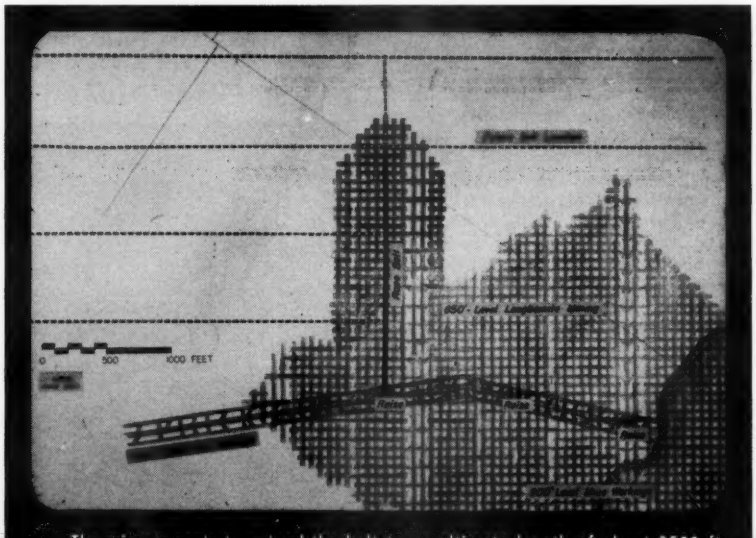
Similarly, it is possible to extend the belt readily. Another feature of the belt which seemed well suited to our use for langbeinite is the ability of the belt to give under load and to change its conformation to suit the load. Management feels that this is an important consideration in the effective handling of mine-run ore. Because of the occurrence of a clay seam in the back on the langbeinite level, even the most careful blasting and the best fragmentation occasionally will produce boulders as large as 16 to 18 in. across. The rope belt gave every indication of being able to handle this material without damage to itself.

Installation Experience

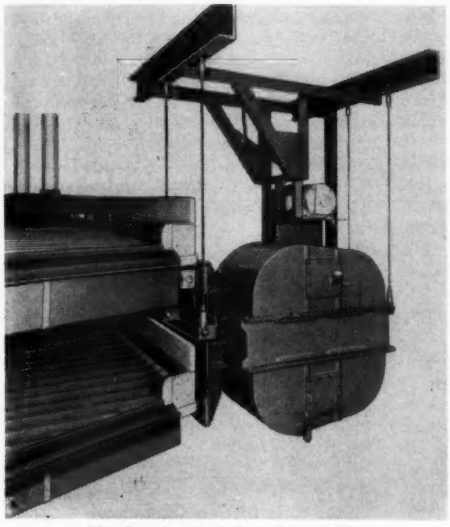
International purchased a 1000-ft rope belt which was to be capable of being extended to 2500 ft. The initial 540-ft flight was installed late in January of this year. The flight used rope spans 160 ft in length and anchored in the roof. The rope is ¾ in. 6 by 19 improved plough steel wire rope with wire rope center. The Goodman linked 2½ in. diameter carrying idlers with prelubricated bearings are placed on four-ft centers. The 2½-in. return idlers are supported on rope stands 16 ft apart. Rope spreaders are placed on alternate 16-ft centers. The belt is 42 in. in width and consists of a 4-ply 42-oz nylon filled cotton duck fabric with a cotton breaker strip and 3/16-in. top cover and 1/16-in. bottom cover. The breaker strip was specified to help improve belt life in handling mine-run muck. The belt operates on a four to five percent downgrade to the raise. The 75-hp drive will accommodate an estimated maximum 2500-ft flight. The head pulley is 24 in. in diameter and the belt is driven by a 24-in. snubbed drive arrangement. The top flight, as installed, is about 32 in. above the floor; the return strand is 6 to 10 in. above the floor. The belt travels 350 fpm.

Since the initial flight was installed, the belt has been extended five times to a total distance of 1900 ft and on all extensions after the initial flight was installed, the ropes are anchored in the floor instead of in the back. The belt is extended about every six weeks and it is done on one shift during the week when the operating crew is off. With adequate advance preparation, the total extension time is approximately six hours. Total labor for extension amounts to about ⅓ man-hour per ft.

(*Continued on page* 44)



The mine expects to extend the belt to an ultimate length of about 2500 ft. At that time a second belt will be installed at right angles to this one, and mine workings will be extended along the new belt with the original acting as a mother belt. The new belt will be advanced to the limits of the ore body and then will be removed to make another pass. The entire ore body will thus be extracted in successive passes.



Headmotion and drive for a right-hand Concenco 77 Diagonal Deck Coal Washing table

The Twin-Deck Suspension Type Coal Washing Table

By F. S. AMBROSE
Consulting Engineer
Fairmont Machinery Co.

and

D. H. DAVIS
Vice-President
Mathies Coal Co.

The first full-size model of this twin-deck table was installed in the fine cleaning circuit of Mathies Coal Co. to test its performance in actual plant operation and to provide information in respect to design and coal cleaning ability. Here is a complete description of the unit and its installation and operation

THIS article will present pertinent information on a new coal washing table embodying a novel means of suspension and head-motion drive. The unit uses the proven deck features of the Deister Super Duty Diagonal Deck No. 7 coal washing table. The new table is the invention of the senior author of this article, Fred Ambrose. The Ambrose invention, for which patent has been applied, is the property of Fairmont Machinery Co., Fairmont, W. Va. An exclusive license for the manufacture and sale of the new table has been granted to Deister Concentrator Co.

A small scale model was first built and tried out in Fairmont's shop where it was determined that the table appeared to be suitable for the cleaning of fine coal. Design of a full size twin-deck table was then undertaken using the decks of the Deister No. 7 coal washing table. The first full size model was built at Fairmont's shop and then installed in the fine cleaning circuit of Mathies Coal Co., Finleyville, Pa., to test its performance in actual plant operation and to provide information in respect to design and coal cleaning ability. This discussion covers the efforts of the three companies—Fairmont, Deister and Mathies—to provide an improved coal cleaning table which will provide greater economy in construction. At the outset it should be stated that the original drive is the only drive that has ever been installed on this table. The test program on the table has been in progress for over a year, during which time it was shut down only to make improvements and adjustments and to change the weights in the drive unit.

Provides Greater Economy in Construction

The conventional coal washing table employs a positive drive to push the table deck against a spring mounted in a firm foundation, the spring imparting a fast return stroke to the table deck in order to bring it back to its original position. This type of drive requires a substantial concrete and steel foundation for the table frame and drive unit and when a large number of tables are used, special floor and steel design must be incorporated into the structure to minimize vibration and movement. This type of construction has added considerable to the construction costs and must be considered as a part of the cost of a coal table plant. Where the tables have been located at a considerable distance above the ground floor, the movement in the structure has often been of considerable magnitude and has required much heavier structural members and better design. The twin-deck suspension type fine coal washing table was invented to overcome some of the disadvantages inherent in the conventional coal washing table mounted in the usual manner. Due to higher tonnage plants being built and because of the higher percentage of ⅜ in. by 0 produced by mechanical mining methods, the floor space and structure required for a large number of tables becomes a very large item in the cost and design of the plant.

There are two major advantages in the use of the new twin-deck cleaning table, both of which result in a large measure of savings in structural building in which it is installed.

First, because the table is double-decked, two full operating decks are installed in the same space required for one conventional single-deck table, thereby saving one-half of the floor space.

Secondly, because the new twin-deck table including its drive unit is wholly suspended by wire ropes, and is thus permitted to swing freely when operating, there is virtually no impact upon the supporting structures and very little vibration in operation, thereby permitting the use of lighter and less supporting structure.

Speed and Length of Stroke Depends on Cleaning Problem

The head-motion or drive unit is driven by a three hp motor through a V-belt reduction at a speed of 285 rpm which consequently delivers 285 strokes per minute to the cleaning table.

In the head-motion is housed a combination of rotating weights, so arranged and geared together to give a combination of forward and reverse forces which result in a horizontal linear differential motion or stroke. This differential motion produces a slow forward movement and a fast return movement which impart a forward conveying action to the table deck. This conveying action will vary with the strokes per minute and also with the length of stroke. With the conventional stroke of ¾ in. and a speed of 285 strokes per minute, this conveying action on dry surfaces of deck is approximately 32 fpm of travel. The speed at which the tables are operated, and the length of stroke used, depends upon the cleaning problem in each case. For handling ⅜-in. by 0 coal with a normal amount of rejects, the ¾-in. stroke with a speed of 285 strokes per minute would in most cases be used. Changing the speed of the drive does not affect the length of the stroke. The length of stroke changes only by the use of the different combinations of rotating weights.

The present design is available in a selection of four stroke lengths, starting with a minimum stroke of 9/16 in. and increasing by 3/16-in. increments, giving strokes of 9/16, ¾, 15/16 and 1⅛ in.

Table Suspended by Wire Ropes

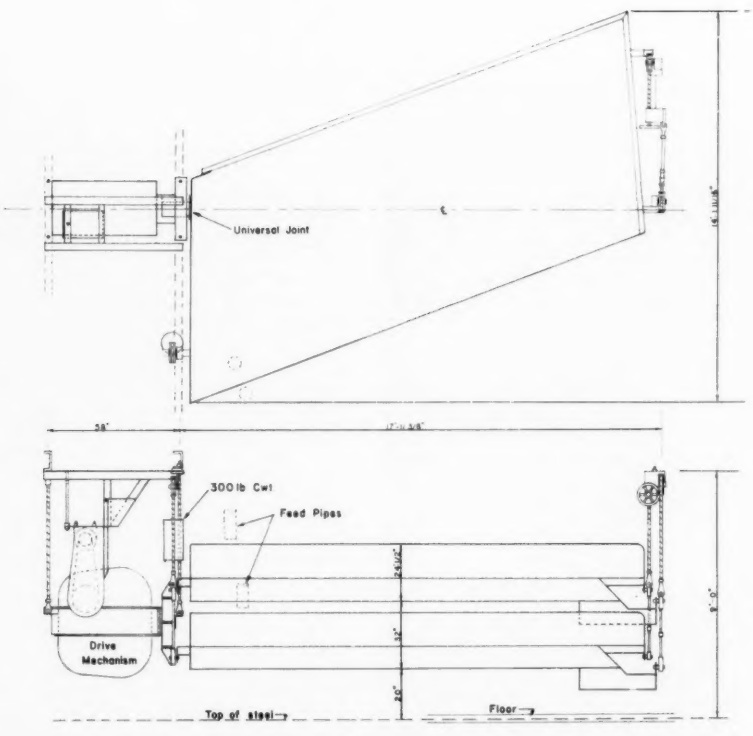
Referring to the accompanying drawing, the unique rope suspension system permits the table decks to be adjusted for end elevation and side tilting while the unit is operating and cleaning coal. This is a very desirable feature, since either one or both adjustments can be made, observed and checked for results without interrupting the plant operation.

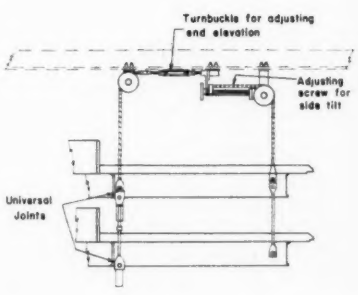
The drive unit is suspended on four ½-in. stranded steel ropes. Attached to the table end of the drive unit is a drive yoke. On the face of this drive yoke are two ball or universal joints. These joints are spaced 32 in. apart vertically and this dimension is the spacing between centers of the table decks.

Each table is mainly supported at two points, one point at each end of the table. At the drive end the table decks are supported from the universal joints referred to above and at the other end they are supported on similar universal joints, but these joints are suspended on a single ½-in. stranded steel rope. These two points of suspension are on the drive axis of the drive unit and also on the center axis of the table decks. Being supported on the two universal joints, the table decks may be rotated about their axes and can be easily tilted to obtain the proper side tilting adjustment.

The refuse discharge end can be raised or lowered above the drive end of the tables to obtain the desired end elevation adjustment. The upper end of the rope supporting the universal joints at the discharge end of the table passes over a sheave supported from the building structure and is connected to a turnbuckle; by turning this turnbuckle the end of the table can be raised or lowered for this adjustment.

As explained above, the table decks are supported on their centerline of axis on universal joints at each end of the table and if they were not held by some means they would be free to rotate about this axis. To secure the table from rotating about this axis, and also to fix their position at any desired position for side tilting, there are two ⅜-in. steel ropes attached to the table supporting frames. These ropes are located, one on each side of the centerline of axis and at about five ft from the centerline of axis. One of these ropes extends up and over a sheave supported from the





General plan and elevations of the twin-deck suspension type coal washing table with Concenco 77 Diagonal Deck

building structure and on the end of this rope is attached a 300-lb counterweight. This counterweight and rope will maintain a 300-lb upward pull on this side of the table. The second rope is attached to the table frame on the other side of the centerline of axis and extends up and over a sheave attached to the building structure; the end of this rope is attached to a screw takeup. By operating this screw takeup, the rope can be let out or taken up, thereby, with the rope and counterweight opposing on the other side of the centerline of axis the table is secured from rotating about its centerline of axis and can be fixed in any desired position for this side tilting feature.

Other Features Described

The head-motion or drive unit is enclosed in an oil-tight housing and all moving parts therein are amply lubricated by the simple splash system. It requires six quarts of oil to fill the system; this oil need only be changed at about every 1500 hours of operation. There being no other moving parts subject to wear, no other lubrication is required and the unit will operate with very little attention except a weekly check on the oil level in the drive unit and inspection of the rope suspension system.

Due to the very high efficiency of the head-motion or drive unit and the absence of friction in this cleaning table unit, the power requirement for its operation is very low. A three-hp motor is required to operate this double-deck unit, whereas, as a comparison, a three-hp motor is required to operate the conventional single-deck table.

A recent inspection of the drive unit on the double-deck test table unit, which contains the only wearing parts, shows no noticeable wear and would indicate that it will operate for many years without any serious failures.

Other secondary advantages are the following:

1. Piping cost to the tables will be reduced by decreasing the amount of piping necessary for any given plant. For instance, the table installed at Mathies has one 6 in. diameter feed pipe for the two-deck table as compared to two 4 in. diameter feed pipes for two single deck tables. Fewer launders for coal and refuse products will be required than for a single deck plant.

2. House-keeping can be improved by eliminating all floor supports, giving virtually an unobstructed floor space. The electric motor support may be suspended or base mounted as desired or required.

The collecting launders are not attached to the table so that the head-motion drives only the table decks. At first the collecting launders were attached to the table decks but required excessive quantities of water to keep the products moving. Any excessive water is undersirable in a coal cleaning circuit because the clarification problem is increased; therefore, the launders were mounted on the floor and eliminated from the table. The motion of the table can be more closely controlled without this additional weight.

The accompanying pictures indicate the manner of feeding the table by means of a splitter box. A single pipe is run from the table distributor to a cylindrical feed box which contains outlets to the top and bottom decks. The dressing water board is the same as of the Deister No. 7 deck and dressing water is regulated in the same manner.

Performance

At Mathies, the average feed to the single deck tables is from nine to ten tph of raw coal per table. It was planned to run tests on the double-deck tables with the equivalent input tonnage per deck as was being handled on the single deck tables. However, at the time of the tests, this was not possible and in the following tests the tonnage to the double-deck table was slightly under that desired and the tests were run at a feed rate of 8.5 tph per deck.

The results are shown in Table 1 and Table 2.

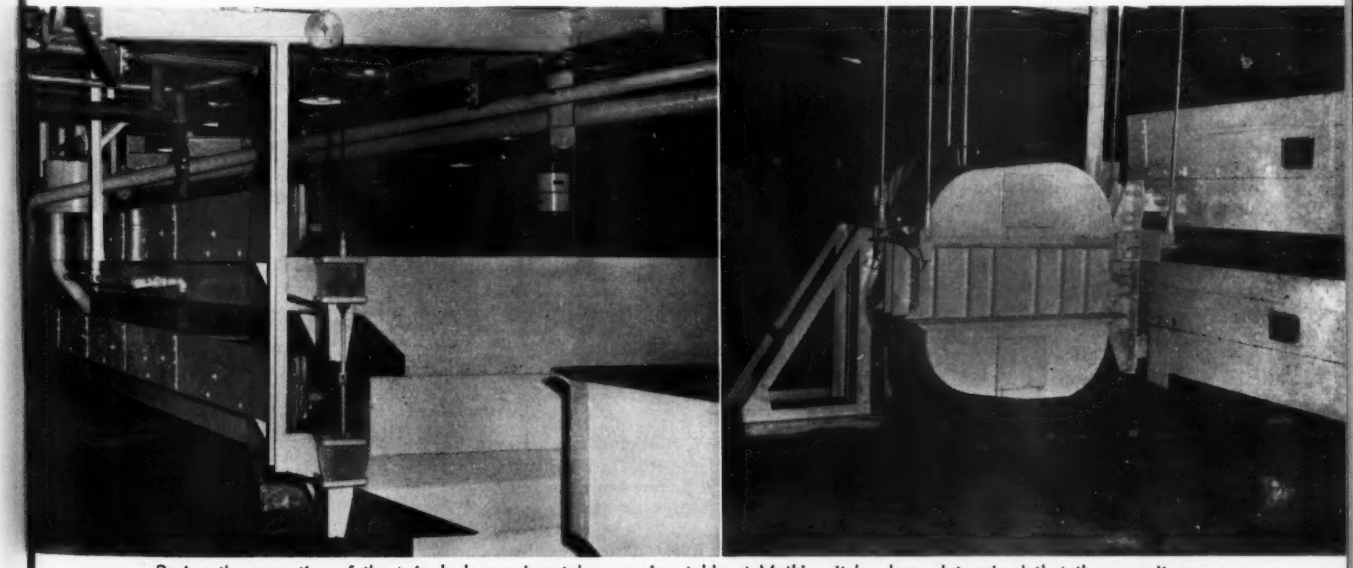
TABLE 1

Ash on Products from Twin-Deck Suspension Table

RESULTS

	% Ash	
3/8" Raw Coal Feed	21.5	
Top Deck, Clean Coal, A	5.8	6.1
Top Deck, Clean Coal B	7.7	
Top Deck, Refuse C	58.9	
Top Deck, Refuse D	82.8	
Bottom Deck, Clean Coal A	5.8	6.1
Bottom Deck, Clean Coal B	7.8	
Bottom Deck, Refuse C	50.2	
Bottom Deck, Refuse D	80.8	
Overall Clean Coal	6.1	
Overall Refuse	70.7	

Sample A First 8′ 8″ of clean coal side
Sample B Remaining 8′ 3″ of clean coal side
Sample C First 3′ 10″ of refuse side from corner
Sample D Remaining 3′ 10″ of refuse side



During the operation of the twin-deck experimental suspension table at Mathies, it has been determined that the capacity per deck is ten tph per table deck with a 3/8-in. by 0 raw coal feed containing 21 to 22 percent 1.60 sp gr sink material

Table 2 shows the results obtained with the table adjusted to produce an exceptionally well-cleaned coal. The results on the clean coal were excellent, although as expected, the loss to refuse was rather great. At least one-half of the 1.60 sp gr float in the refuse consists of 1.40 x 1.60 sp gr intermediate gravity material and unless this was sent to refuse it would not have been possible to produce a washed coal of 5.1 percent ash. The results indicate that a separation was being made at or about 1.50 sp gr. The reduction in ash content on the 48 by 100 mesh and 100 by 200 mesh was exceptionally good.

During the operation of the twin-deck experimental suspension table at Mathies, it has been determined that the capacity per deck is ten tph per table deck with a ⅜-in. by 0 raw coal feed containing 21 to 22 percent 1.60 sp gr sink material. With a feed containing less sink material, the capacity might be higher than ten tph per table deck.

Tests indicate that the water requirements are the same as that for a single deck conventional table and at Mathies the water requirements are:

Ratio of Water to Solids	
Clean Coal	1.9 to 1
Refuse	1.3 to 1
Total	1.7 to 1

TABLE 2

Sizing & Sp Gr Separation Tests on Products from Twin-Deck Deister Table Adjusted for Producing A Low Ash Coal

	SP. GR. SEPARATION ON PLUS 48 MESH					
	RAW COAL		CLEAN COAL		REFUSE	
Specific Gravity	% Wt.	Ash	% Wt.	Ash	% Wt.	Ash
1.60 Float	78.2	5.9	99.8	5.0	32.9	11 8
1.60 Sink	21.8	77.5	0.2	42.4	67.1	78.1
Head	100 0	21.5	100.0	5.1	100.0	56.3
SIEVE SIZE	% Size	Ash	% Size	Ash	% Size	Ash
Plus 4 Mesh	25.9	23.3	28.1	5.4	22.9	65.6
4 M x 8 Mesh	25.6	23.0	30.6	5.1	24.8	62.7
8 M x 14 Mesh	19.2	22.4	19.5	5.0	20.1	57.3
14 M x 28 Mesh	12.1	21.9	10.7	4.7	15.6	46.0
28 M x 48 Mesh	7.6	22.2	6.6	5.1	10.8	40.0
48 M x 100 Mesh	4.2	25.9	2.9	6.0	4.3	53.3
100 M x 200 Mesh	2.0	26.0	0.7	10.1	1.0	65.1
Minus 200 Mesh	3.4	30.2	0.9	22.7	0.5	53.9
Plus 48 Mesh	90.4	22.7	95.5	5.1	94.2	56.9
Minus 48 Mesh	9.6	27.4	4.5	10.0	5.8	55.4
Head (Calc.)	100.0	23.2	100.0	5.3	100.0	56.8
Head (Actual)	—	24.5	—	5.4	—	56.9

The accompanying pictures show the features of the twin-deck suspension table. It is to be noted that while this is an experimental table, it had to be tested as a full-time operation unit in the same manner as other units in the plant in order to adequately determine its performance. The present form of the suspension and means of adjustment are the results of trying several designs in order to determine the most practicable. The table is now of commercial status and should prove to be very successful in operation. For existing plants it would not be difficult to design a single deck suspension table which could be suspended above the present foundation mounted single deck table and in this manner increase the cleaning capacity of the existing plants.

OPERATING EXPERIENCE WITH STEEL CABLE-SUPPORTED CONVEYORS

(*Continued from page* 40)

Tons Per Manshift Increased

One of the primary objectives of the belt installation was to keep the shuttle car haul to a minimum and to completely eliminate the use of trolley. The mine plans to limit the haul to about 300 ft on the average. Few changes in our mining system were necessary to adapt it to belt operation. The workings are extended along the belt line in an inverted "V."

The 60E15 shuttle cars were modified in our own shops for elevating head operation so that they could load directly to the belt over the tail section. The belt tail section is designed to accommodate the six-ft wide shuttle car discharge over the end or from either side. The shuttle car deposits its load on the belt in less than a minute.

The installation of the belt has made it possible to reduce from five to only two or three the number of cars which are operating. It was also found that our close attention to fragmentation and blasting increased the speed and efficiency in loading. The elimination of overhead trolley installation was another major saving. For the face production crew only, the number of tons per manshift was increased about 35 percent over our former operation.

Further Improvements Are Probable

The practice of loading from shuttle cars directly on the belt has not been entirely satisfactory and management is now investigating some intermediate feeder arrangement into which the cars could discharge. This feeder would absorb the initial impact of the load, would speed it up to almost full belt speed and would help to center it on the main belt. This proposal is now being investigated thoroughly.

More than a half-million tons of ore have gone over the belt, thus far, but no signs of wear have been detected. The few unfortunate cuts and gouges in the top cover have not damaged the carcass. There has been no edge wear. Management feels that these problems will be eliminated in the future through the use of a feeder belt. It has been necessary to train the belt too often and there is some tendency for the carrying idlers to move on the ropes. Work is now being done to re-design the method of clipping the carrying idler assembly to the rope so that it cannot move readily.

It is expected that this particular belt will be extended to an ultimate length of somewhere in the neighborhood of 2500 ft. At that time a second belt will be installed at right angles to this one and mine workings will be extended along the new belt with the original belt acting as a mother belt. The new belt will be advanced in similar fashion to this one to the limits of the ore body and then will be removed to make another pass. The entire ore body will thus be extracted in successive passes.

To summarize, the rope belt conveyor has proven to be a flexible, high-capacity, useful piece of equipment in langbeinite mining and it has made possible improvements in our mining operations.

Allis-Chalmers HD-6
63 belt hp
up to 15,500-lb drawbar pull
forward speeds from 1.5 to 5.5 mph
reverse to 4.1 mph
15,850-lb (approx. as illustrated)

MORE DRAWBAR PULL . . . BETTER DOZING SPEEDS EASIER HANDLING . . .

. . . than anything near its size

More drawbar pull for extra output . . . up to 44 percent more drawbar pull enables the HD-6 to handle tougher jobs — bigger loads than other crawler tractors in its size.

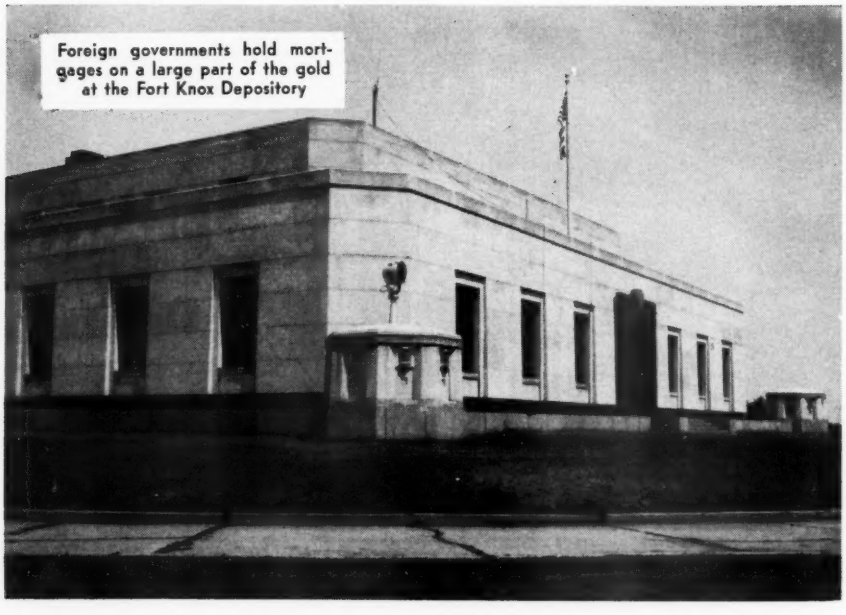
Better dozing speeds . . . five forward speeds — including a 1.5 dozing gear as standard equipment — provide the right combination of power and speed for better dozing and higher production.

Easier handling . . . owners and operators of an HD-6 like its easy-to-reach controls, low lever pull clutches, direct electric starting and convenient rotary-valve dozer control.

Ask your Allis-Chalmers construction machinery dealer to demonstrate the HD-6 on your job. You'll agree that the HD-6 is the best tractor-dozer in its size. Allis-Chalmers, Construction Machinery Division, Milwaukee 1, Wisconsin.

ALLIS-CHALMERS *Engineering in Action*

Debasement of Gold



Foreign governments hold mortgages on a large part of the gold at the Fort Knox Depository

By FRANZ PICK
Publisher
Pick's World Currency Report

AMONG the minerals produced in our states, gold — statistically speaking—plays only a minor role. The value of last year's gold production, about $65,000,000 or 58 tons of the yellow metal, could be condensed into a cube about 4½ feet high. Its value is less than one average day's volume of transactions on the New York Stock Exchange. It can also be defined as 1/70 of one percent of the gross national product.

But, even if the United States gold production were non-existent, gold, whether we like it or not, influences this nation's destiny. It is the constantly functioning monetary conscience of the globe. It is also the obsession of the some 110 to 120 financial administrations that rule the savings and the accountings of individuals, corporations and naturally, of governments.

To have a conscience is a considerable burden for governments, because it demands ethics, holiness of commitments and promises, and justice. Conscience also requires elimination of political favors and of political pressure groups. Ethics exclude favoritism, corruption and graft, in short all things that the holy scriptures condemn. Ethics would also demand that one of these old Double Eagles should still be worth twenty good Dollars, instead of 40 to 42 paper units. And this is the basic story of the gold problem.

History of Monetary Gold

Gold, at all times, has bothered legislators. It has had more power than the rulers who exercised it, whether they were emperors or people's commissars. There has never been enough of the precious metal around—either for the sovereign prince or for the people. And for this reason, it has been and is a cherished possession and it became a standard of value and wealth for countries and individuals. The knights of the Crusades did not want to free the Holy Land from the Turks—they organized their expedi-

by U. S. Monetary Policy

Living in an economy based on money, we have seen "paper currency managers" succeed in cutting the value of the dollar in half, shifting the burden of our debts to future generations, and drastically reducing domestic production of the most perfect monetary material—gold. Here is an analysis which explains why a bitter day of reckoning must eventually come.

tions to find gold. Christopher Columbus sailed West with only the idea of securing the West Indies gold for Queen Isabella, who in turn financed him solely for this purpose.

When gold, by the skill of the British, became a cover for paper money late in the 17th century, it served as a basis for the creation of credit and the progress of industry. During the nineteenth century, what was called the gold standard of British make was the dominant monetary philosophy. Banknote issues were of rather modest proportions, and in those days, believe it or not, the main ambition of a minister of finance was to be honest and not to cheat for his own pocket or for his government's glory. Therefore, people had confidence in their monetary leadership.

World War I, with its then sensational expenses for destruction, ruined the idea of financial honesty of governments. The gold standard died for good in 1914, when the first modern legislation of non-convertibility of paper money was created in Germany and Austria and rapidly adopted in France, England and later in the United States. The inflationary orgies in Europe led to the pitiless punishment of all people, who in earlier years had lent their savings to their governments in order to be left holding absolutely worthless paper adorned with high fidelity print of meaningless promises to pay. From then on, expropriation of the bondholder became an accepted part of civilization.

Timid returns to the gold standard in the late twenties of this century could not hold for long. When on September 21, 1931, Great Britain reluctantly devalued Sterling, the end of the gold standard was virtually sealed. The United States, in an amateurish currency reform on March 6, 1933, outlawed private possession of gold. With the Supreme Court legalizing the new rule, the adoption of the system of "managed paper currency" began.

The 1934 "Paper-Dollar" remained respectable only until the end of 1939, when World War II started.

Franz Pick, one of the world's leading currency experts, is feared by administrations of non-convertible monies, but universally respected for his clarity of judgment. Born in Bohemia, he studied law at the University of Leipzig, currency theory at the University of Hamburg, and inflation and devaluation theories at Paris' Sorbonne.

He fought in World War II in France and played a major role in currency intelligence and underground finance.

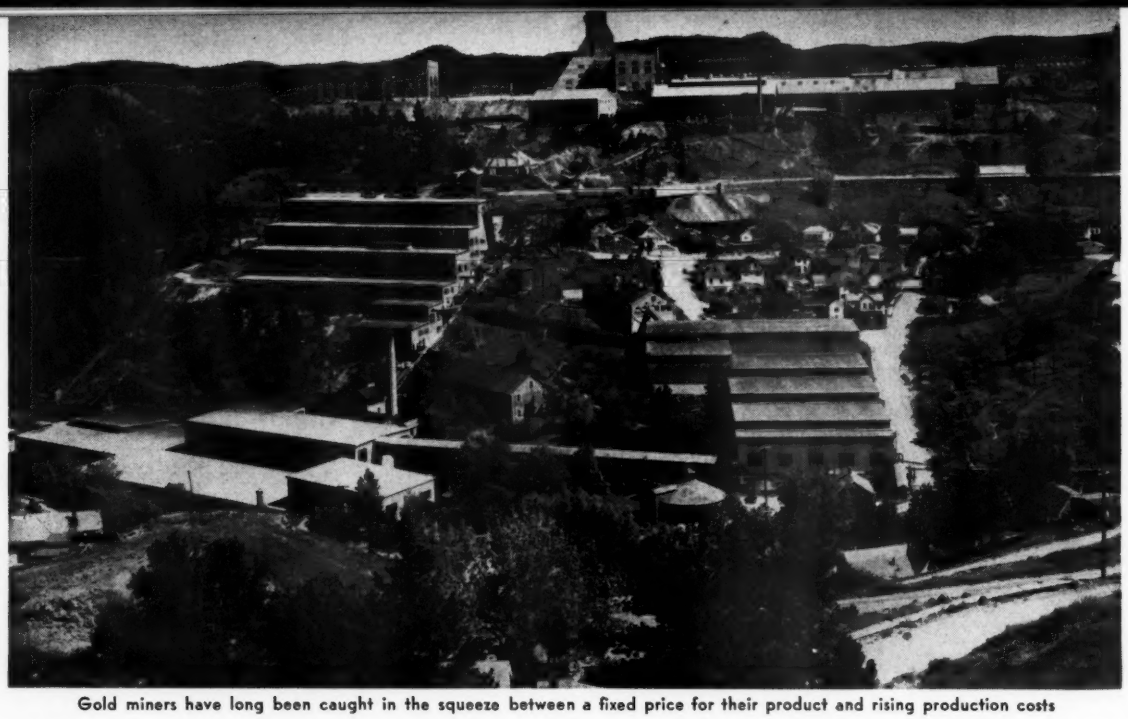
In 1945 he founded "Pick's World Currency Report," and from 1951 to 1955 he published the "Black Market Yearbook." His "Pick's Currency Yearbook," which reviews about 85 currencies each year, is a nightmare for many governments, but an unmatched guide for every foreign trader. In 1955 he established his "Currency Seminar for Junior Executives," a course for key corporate personnel. Among his clients are about 48 foreign governments and many of this country's leading enterprises.

Managed stability was abandoned. It is true that efforts were made to prevent the value of the Paper Dollar from falling too fast. The different regulations concerning the domestic price level, with all their shortcomings and gigantic grey or black markets, may still be remembered by many of you. The "siphoning off" of so-called excessive purchasing power by making millions of people buy billions of Government bonds also may still rejoice those who bought them with "good" Dollars and still have them today. The monetary managers of the country could not burden their thinking with ethical considerations.

Therefore, they had to set their minds to a policy of cynical postponement of the real monetary issue for as long as possible. The major question was and is the maintenance of full employment. The value of the Dollar is secondary. The value of gold, on the other hand, is a complex of such scope, that no one in the administration wishes to cope with it. For these reasons, it has become a hot potato that simply cannot be touched.

The 49-Cent Dollar

Our Dollar is theoretically defined at 888.6706 milligrams of fine gold or at 35 Paper Dollars per ounce of the fine metal. This definition is some sort of window dressing for the uninformed. It has become absolutely obsolete. The reason for it is rather



Gold miners have long been caught in the squeeze between a fixed price for their product and rising production costs

simple. Having been faced with gigantic expenditures during the war and post-war years, we had to decide whether we wanted the nation to pay for them or whether we wanted to shift their payment on to the next generation.

Paying would have caused a lot of trouble, as it would have brought about a constellation that is, in general, called deflation. Declaration of nonpayment would have caused even greater hardships, as it would have been tantamount to nothing less than a state bankruptcy. So we chose the easier solution. That was a mixture of both tactics: the willful debasement of currency value, popularly called the rise of the cost of living.

By this policy we kept the illusion of the 100 cent Dollar alive, but we reduced the amount of goods or services that this Dollar could buy. And we did so well with this policy that the Dollar of 1939 today buys only about 49 cents of what it purchased 18 years ago.

This policy of slow but persistent debasement of the monetary unit, falsely called inflation, is blamed on labor as well as on management. According to my opinion, it only can be referred to the legislators. If they would not have liked it, they could have stopped the procedure. But for such a step a lot of knowledge and courage was and still is needed.

As we depreciated the Dollar, we also debased the gold price. The parity, still defined at $35.00 per oz, is an absolute illusion. In 1939 Dollars, it is only $16.95 per oz. The administration, publishing a monthly cost of living index, has thus far resisted applying it officially to the gold price.

Such facts, concerning only top Government thinkers and many specialists of the gold mining industry, do not interest the man in the street, the banker or manufacturer. They all have discarded the idea of considering gold as an important factor in monetary matters. These "outsiders," praying for and counting in Paper Dollars, have been victims of anti-gold propaganda and believe that gold has to be discarded in any consideration of monetary problems. They have fallen for Lenin's opinion that gold will soon become almost worthless. In spite of having erased the gold idea from the thoughts of 99 percent of the domestic population, we cannot erase it from the thinking of 1 percent of our citizens and from public opinion abroad.

We have about $31 billion of banknote circulation. In addition, there are about $220 billion of bank deposits. This total of $251 billion is "backed" by about $22 billion of gold. The layman is told that such a cover is sufficient to keep the system on an even keel.

The more sophisticated economist has learned, over the recent years, that this $22 billion U. S. gold stock is mortgaged by anywhere from $9 to $13 billion of Dollar deposits of foreign governments in this country. According to the Gold Act of April 1934, these foreign governments can, at any time, demand the immediate gold conversion of their monetary assets in the U. S. In a recent hearing in the Senate, Secretary George M. Humphrey stated that if all these governments would ask for the gold conversion, we would not allow them to do so. Such a menace of a "gold moratorium" is not exactly a promising statement for the nations that had confidence in our monetary system.

Should we really adopt Mr. Humphrey's suggestion, the Dollar would dip overnight in the world's free markets and would be immediately cut in its value by an additional slice of 10 percent or 20 percent or more. Black markets of gold would spring up all over the country and I would not be surprised to see the moratorium—if applied—followed by currency restrictions, prohibitions of capital export and many other measures of financial torture of the individual.

Eventual Revaluation

But, before we reach such a critical stage, we will continue to play as if we were financially sound. We will try to forget about gold and will—without preaching it—continue to favor the domestic debasement of the purchasing power of the Dollar more and more. Thus we hope to keep the carriage going and everybody happy.

However, debasement of purchasing power, even if kept at only a three to four percent loss for every year, is a rather gruesome thing. It not only hurts every bond holder or owner of paper money, life insurance, annuities and other assets, but it also complicates the task of governments. And as any ruling body faced with three different solutions, invariably will choose the least intelligent of the three possibilities, we will do the same. And should we lose another 25 percent of the 1939-Dollar, which,

even without gold embargo, can easily happen within five to seven years, we will have to proceed with another currency reform. This reform, which may justifiably be called state bankruptcy, can only be made over a revaluation of the gold price.

Surely, if we wanted to do so, we could avoid it, but the price to be paid by the nation would be much too high—a sharp recession, with more than 10 million unemployed, with waves of bankruptcies and substantial social unrest. And that, I do not think, we will do.

Rather, we will try to carry the decline of the domestic Dollar value to further historic lows. In the meantime, we will hope for miracles that cannot happen. Should we reach the 25-cent Dollar value of 1939 purchasing power, gold will be really worth only $8.75 per oz. International complications would be at hand at this moment.

And that will be the time when gold, apparently handcuffed by the wishful thinking of government economists, will show that it cannot be manacled, because one fact remains sure: every change of currency value will have to be defined in the yellow metal. Governments here or elsewhere have no substitute for monetary definitions and we will once more surrender to the measuring rod which alone enables us to wipe out part or all of our official domestic debts.

Currency Debasement Will Continue for the Present

American gold production is a very small island in the ocean of this country's total production. The Government, very unhappy to have a gold mining industry which reminds Washington constantly about its bad mistakes of gold policy since 1934, cannot get much gold from its domestic output. Therefore, in all probability, it will not take any measure which would just be only favorable to the owner of our gold mines.

The present world cannot return to the gold coin standard. Such a return would immediately show more than any other fact, to what degree the obedient and patriotic citizen got expropriated by the rulers whom he respects. You all may know about the gold Sovereign, once upon a time worth just one Pound Sterling. Today, the same gold Sovereign fetches £3.12/6 in Paper Pounds. The French Napoleon of 20 Gold Francs is listed at about 3,725 present Paper Francs. Our once famous Eagle of 10 Gold Dollars is worth about 20 paper Dollars. Whereas the British and the French know about such facts of life, we were prevented for about 20 years from knowing it, as dealing in our gold coins was illegal until 1953.

The same Eagle of ancient ten Dollar value, might go to 30 or even more "New Dollars." This fact alone would be a rather embarrassing and constant accusation of our past and present legislators. Therefore, we will avoid making it too visible for the man in the street.

It also cannot be stressed often enough that we simply have not enough gold to make such a step possible. We really own, without mortgage, about $10 to $13 billion of gold. Should we return to a gold coin standard, even after a devaluation and with a double amount of simply "up-valued" yellow metal, this still will not be enough.

A look at the figures will prove my point of view:

	(In Billions)
Circulation of banknotes	$31.0
Bank Deposits	220.0
Federal Debt	275.0
Total	$526.0

All of these items are federal commitments and as such would be convertible into gold. If only covered by a 20 percent gold cover, more than $100 billion of the yellow metal would be necessary. If covered by only 15 percent, we would need about $79 billion of gold.

Unfortunately, there is not enough gold in the entire world to cover such needs. The global gold position showed, at the end of 1956, the following breakdown:

	Billions of Paper Dollars at $35.00 Per Ounce
United States	$22.058
Soviet Union	7.600
Switzerland	1.676
Great Britain	1.650
West Germany	1.494
Canada	1.103
International Agencies: IMF, EPU, BIS	1.975
All other countries	8.644
Total	$46.200
Estimated Private Hoards	11.900
	$58.100

This total gold stock of the world corresponds to about 58 years and 9 months of the present gold production of the non-Soviet countries. I believe that such figures sufficiently prove that neither we, nor Britain and certainly not China or the U.S.S.R. can plan to make their currency units and bank deposits convertible into gold coins, freely available to the public.

Prospects for the Miner

We in this country will probably not see gold in monetary private use again. Therefore, I believe that the present restrictions on ownership will not be eased in the foreseeable future and the gold monopoly of the Government will remain as is.

Thus, the owner of gold mines does not have a rosy future in sight. Surely, there is no other solution to our currency problems, than a good devaluation, which means a 100 percent increase of the so-called official gold price. But such a frank declaration of bankruptcy, even if applied, will take years to come. I have no doubts that it will happen. In the meantime, all administrations which will assume office will try to deny that such a possibility exists. That is their way of reassuring the public and selling bonds.

Yet, when the present shrinkage of the Dollar's value will have run to the inevitable end of its cycle, which will bring about the dreaded "recession" of unpredictable intensity, the government will then act and increase the gold price. Only a shrewd crystal ball reader could predict the eventual date of such a decision.

As we will have to wait before the gold price is increased, it might be useful for those who mine gold to put their mines into some sort of dormant position. Whether it will be three years or five or six, before it happens, the waiting period, even in Paper Dollars, will be costly.

Those who can "sit it out" will make profits when they start to produce again after the gold price increase. Those who cannot, will do well to diversify, in order to survive the waiting period. Finally, those who buy claims on rich subsoil should be sure to be able to reap their profits, only at a future date.

Gold mining has become unattractive, as wages and other expenses have by far eliminated every profit at the real gold price of about $17.00 per oz in 1939 Dollars.

There are no other conclusions to the problem.

We have, in the U.S., just one trillion Paper Dollars of public and private debts. The amount is growing. Between March 1956 and March 1957 the purchasing power of the present Dollar was reduced by 3.7 percent. If applied to the "Trillion" of total debts, an amount of $37 billion has been simply wiped out. This sum, corresponding to more than half of total budget expenditures, created the negative incentive for keeping the present boom going.

Unfortunately, this boom cannot continue eternally and will, one day, collapse. With this crumbling, a new Dollar will be born.

It will be defined in milligrams of fine gold—less than the present number, but how many or how few, I do not know. And I sincerely doubt that we will, even if we increase the gold price by 100 percent or more, again return to some real gold standard.

There will be no chance of seeing U.S. gold coins minted in any of our mints as long as we live. We will only use the yellow metal officially when we are forced to legalize a period of debasement of paper money.

This is bitter medicine. But, as facts cannot be changed, mining men should accept it. It might be better for them to know where they stand, instead of hoping for events that most probably will not happen.

Finding and Training

MINE MECHANICS

In its search for mine mechanics in a labor market where there was none, this 14,000-tpd coal producer decided to start from scratch and set up a mechanic training program. Prospective trainees were screened by interview and aptitude testing. The men chosen have received on-the-job training in conjunction with a lecture and classroom study program

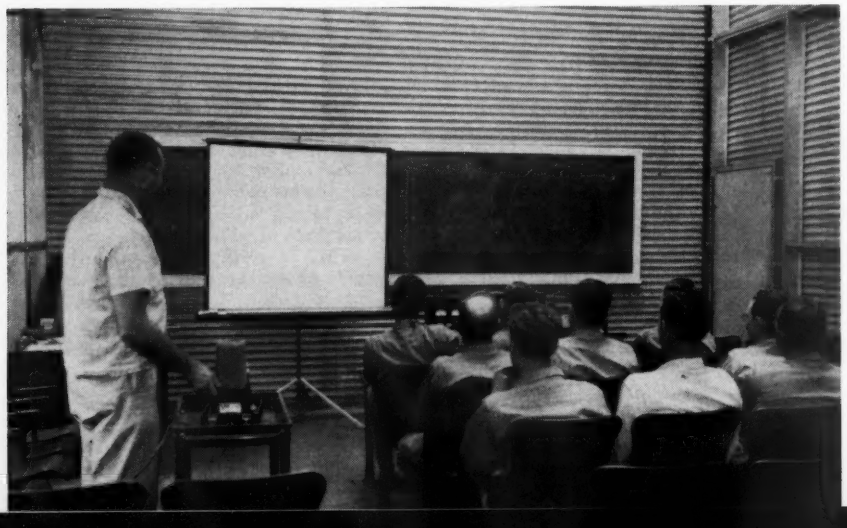
By W. C. SCHOTT
Vice-President and General Manager
Stonega Coke & Coal Co.

ABOUT five years ago Stonega Coke & Coal Co. employed approximately 3300 men, with 55 percent of its coal being loaded by mechanical means. At that time management started a program for full mechanization and three years ago attained practically 100 percent of mechanization. Today the company employs approximately 1300 men, with the production of 37 percent more tonnage than in the era of hand loading.

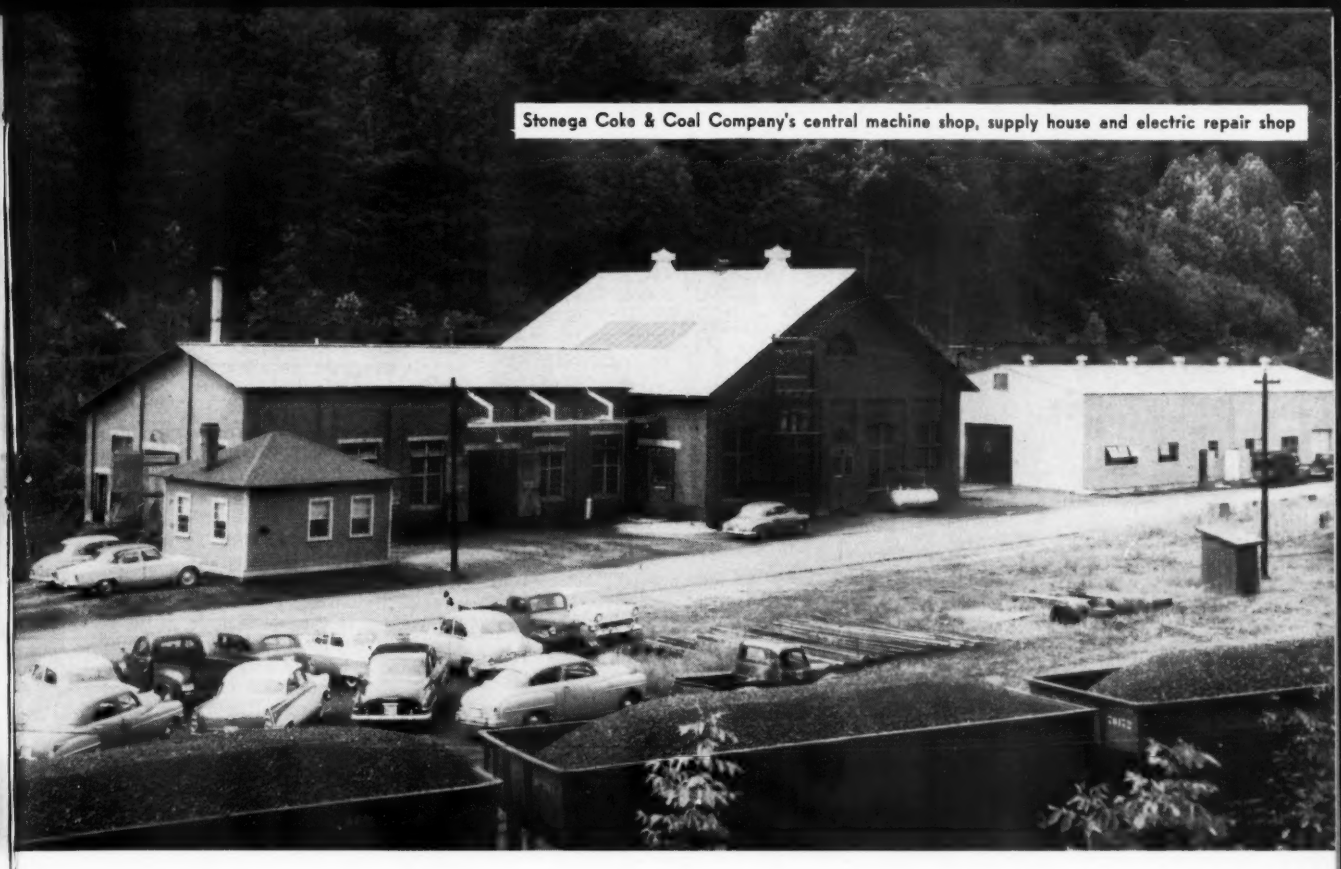
This change-over greatly disturbed the age-balance of our employees, with the older employees filling most of the available jobs through their seniority and the younger men forced to seek work elsewhere. Stonega was fortunate that the mine men who were retained were very readily trained for operation of loaders, cutting machines, roof bolting equipment and shuttle cars.

However, about 2½ years ago the company was faced with a marked shortage of men with the necessary training and experience to maintain the mine equipment in the operating condition that is fundamental with a good mechanization program. The company also found that a certain percentage of its mechanics were unable to cope with all phases of the work required in the repair and maintenance of the later and improved mining equipment.

It was, therefore, decided to institute an extensive training program to accomplish the dual purpose of providing mechanics to augment our present mine repair force and also to



Part of the training program is conducted in the central repair shop classroom where the basic fundamentals of lubrication, hydraulics, mechanics and electricity are explained and illustrated. A special effort is made to have the lecture material coincide with the particular type of work being encountered by the trainees at that time



Stonega Coke & Coal Company's central machine shop, supply house and electric repair shop

provide a force capable of rebuilding and reconditioning the mine equipment which requires this type of work.

Mining and Maintenance Organization

At the present time Stonega is operating seven fully mechanized mines and three additional tipples over which stripping and auger coal is prepared and is producing approximately 14,000 tons per day. Our types of mechanization require mobile loading machines, short wall and mobile cutting machines, roof bolters and shuttle cars, main or mother belt conveyors, panel belt conveyors and room conveyors. The company also has two continuous miners of the auger principle.

At each mine there is a general repair force which averages from seven men at the smaller mines to 15 at the larger ones. The mines carry on a general repair and maintenance program and some minor overhauling of equipment. Stonega also has a central machine shop with an employment of 37 mechanics, electricians and armature winders and here is where it centralizes the reconditioning and rebuilding of the mine equipment. To take care of this expanded and accelerated rebuilding program at our central shop, last year the company erected a large addition in which it housed the armature shop, supply house and also the lecture room for the shop school. Moving the armature shop from the old shop building released the additional space for the rebuilding program. The company is able to handle three to four pieces of equipment at one time for rebuilding purposes.

Selecting Trainees Difficult

When it became known that Stonega intended to inaugurate a training program, it was deluged with applicants for this work, some making application from as far as 50 miles distant. Some of these candidates were satisfied to make any sort of arrangement necessary to be included in the program. Several veterans made the proposal to use their G.I. rights to be included.

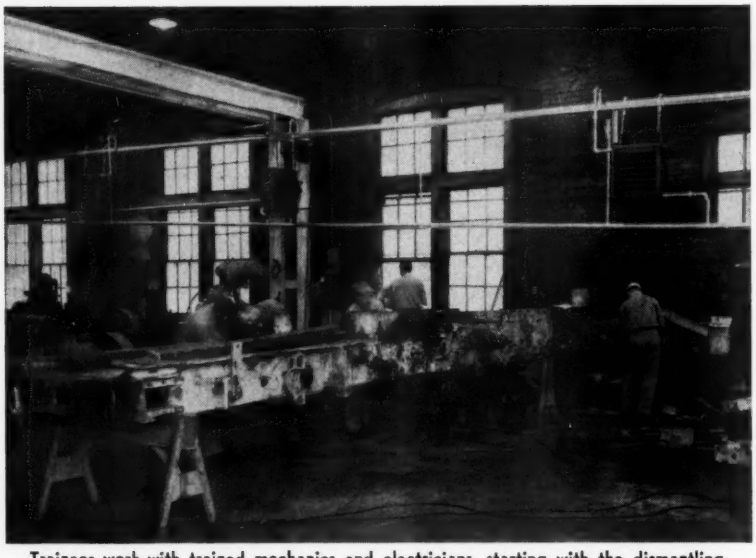
Since our mines operate under contract with the United Mine Workers of America, management approached them on our plan. They were enthusiastic with the entire program and felt it was very laudatory on our part to initiate such a step.

As it was going to take a great deal of instruction time in the first stage, it was decided to start with a panel of seven trainees. The following potential time schedule was set:

First six months—basic training.
Six to twelve months—evaluating period.
Twelve to eighteen months—helpers.
After eighteen months—to mine mechanics.

Everyone understands that the determination of the progress and retention of the trainees is at the full discretion of the management.

The most difficult part was to select the trainees from the many applications received. Of the candidates initially interviewed who management felt were of the type required, approximately 50 were selected for personal interviews by our superintendent of the Power and Mechanical Department, assisted by our mechanical and electrical inspector, at which time all their personal facts were ascertained. These written interviews were then reviewed by a board consisting of the two mentioned above together with the writer and the two division superintendents. The board could not make any full determination or selection from the facts it had gathered and it was decided to give approved aptitude tests to determine their capabilities, intelligence, knowledge, and aptitude for the type of work they would undertake.



Trainees work with trained mechanics and electricians, starting with the dismantling of the equipment and going right through to the final assembly and testing

Two Aptitude Tests Given

The first aptitude tests were given to 41 candidates and from these tests the list of potentials was cut to 12. A more advanced aptitude test to these twelve eliminated two more. Since only seven were required, it then became a matter of personal judgment to choose the first draft. In this final selection, preference was given to boys that came from families that were old employees of the company. Six men were assigned to the rebuilding program at the central machine shop, and one man who had sufficient experience was assigned to one of the mines.

It was found in these tests that the men with Navy or Air Force training who had high technical ratings generally came out favorably in the tests.

Regarding the 29 men who were rated behind the first 12 in the first aptitude tests, the writer wishes to state that possibly 15 to 20 would have and will make excellent men. It was very difficult to set up definite standards of selection to pick only six men. The age group of all applicants was from 20 to 35, with the ones chosen from 24 to 32—average age 26.5 years. A fine group of young men participated in the first aptitude tests and it was very gratifying to know that this type of young man is available.

The aptitude tests used were recommended by friends at Virginia Polytechnic Institute and are published by the Psychological Corp. The first tests the company gave "Test of Mechanical Comprehension—Form AA", are designated as suitable in difficulty for industrial jobs and high school students. The second and final test was "Mechanical Comprehension Test—Form BB", which was designed to measure various types of physical and mechanical relationships. These tests were supervised by college graduates in electrical and mechanical engineering. It was felt that no further tests were required; generally tests in higher categories than the ones given need professionals or psychologists to supervise and interpret.

Classroom and Shop Instruction

These trainees work in the central shop primarily on the rebuilding and rehabilitation of equipment. They work with our trained mechanics and electricians, starting with the dismantling of the equipment and going right through to the final assembly and testing.

In conjunction with this work, a lecture and classroom study program was initiated. This part of the training program is conducted in the central repair shop classroom which is equipped with a lecture and demonstration table, a large blackboard and an opaque projector and screen. Through the use of these facilities, the basic fundamentals of lubrication, hydraulics, mechanics and electricity are explained and illustrated. A special effort is made to have the lecture material coincide with the particular type of work being encountered by the trainees at that time. Management has representatives of various manufacturing companies give lectures on various phases of care and maintenance, construction, including mechanics, electricity, and hydraulics. Their help and aid has been very satisfactory and welcome.

The company has also instituted the Lonesome Pine Council of the Mining Electro-Mechanical Maintenance Association with 140 active members. All our trainees belong to this association and the lectures which are put on at regular intervals are very helpful to all concerned.

In conjunction with the State of Virginia, Trade and Industrial Education Branch, Stonega is starting classes in fundamentals of Electrical and Mechanical courses.

Our program has now been in effect seven months and the results have been about what was anticipated. Every month these men are rated on a point basis by members of the supervisory staff and at this time our tests and judgment of the men seem highly justified.

Stonega has just recently opened a new mine, which will require 10 to 12 mechanics and repairmen. There are practically no trained men available. Therefore, it was decided to use several of the more advanced of our trainees as helpers and give them the necessary training at the source of trouble. This necessitated the starting of additional trainees, which were procured by the same methods as above.

Program Has Proved Satisfactory

There are several factors connected with this program which management feels can be improved upon. It would like to have one or two men with the attributes of complete knowledge of all the equipment and then be able to put on lectures to the trainees and also assist them in the actual work of assembling, etc. Also, management is not too certain that it can train these men on all types of mining equipment. However, it is felt that they will receive enough of the fundamentals of repairs to be able to cope with any type of mine equipment the company may have.

Stonega is anticipating in the next several years a fairly large turn-over among its mine men, due to retirement, etc. At the present time very few men with the proper potential to operate mine equipment are available. Management is using the aptitude tests as a criterion in selecting some of the new mine employees and feels that employees with the proper intelligence and aptitude will make the most acceptable operators.

The company also feels as time goes on that it can greatly improve its present program, particularly in the methods of instruction. It feels that by starting new trainees on a staggering system, the older trainees will be able to greatly assist the new men.

Summing up this entire training program, management feels that it was and is the only sound way to procure and develop the right type of men for this training and the only logical way to train them.

FIGHTING A MINE FIRE WITH CO_2

The use of carbon dioxide gas in conjunction with carbon dioxide as dry ice permitted almost immediate control and extinguishing of a fire at a Michigan iron mine

By F. J. HALLER
Vice President-Operations

and

F. G. MICHELS
Safety Director
North Range Mining Company

THE use of carbon dioxide in liquid and gaseous form is not new in the Lake Superior District, but its use in the control of mine fires has been infrequent. Carbon dioxide in the form of dry ice, to the best of our knowledge, had not been used for this purpose in the Lake Superior District until last February, when a fire occurred at the Penokee Mine at Ironwood, Michigan. The results obtained with carbon dioxide gas in conjunction with carbon dioxide as dry ice to quickly control this fire exceeded our hopes and expectations.

A fire must have combustible material, oxygen and heat. The elimination of any one of the three components will extinguish it. However, if both the oxygen and the heat can be eliminated at the same time, the fire will die out almost immediately. CO_2 properly applied, can accomplish this very quickly.

Carbon dioxide is an inert gas, one and one-half times as heavy as air at atmospheric pressure. It does not support combustion. It is stored as a liquid and as a solid, commonly known as dry ice. In the form of dry ice, carbon dioxide has a melting point of —56 degrees C. However, it sublimates at —78 degrees C. at atmospheric pressure. One pound of dry ice will produce nine cu ft of gaseous CO_2, also at atmospheric pressure.

Carbon dioxide is maintained for industrial use by the manufacturers as liquid under pressure in small cylinders, as liquid in tank trucks and in the form of dry ice. The manufacturer whom we contacted for carbon dioxide discouraged the use of liquid in tank trucks because there is only a small amount of vapor CO_2 in the tank and when this is withdrawn rapidly the temperature of the liquid CO_2 in the tank drops and becomes a solid mass resembling dry ice. The use of carbon dioxide in cylinders can also present a problem. The lines will freeze if the gas is allowed to escape from the cylinders too quickly and if the cylinders are tipped at an angle while discharging. Dry ice presents no problem if not stored too long. It is shipped in 116-lb cartons, two blocks per carton and should be handled with ice tongs or gloves.

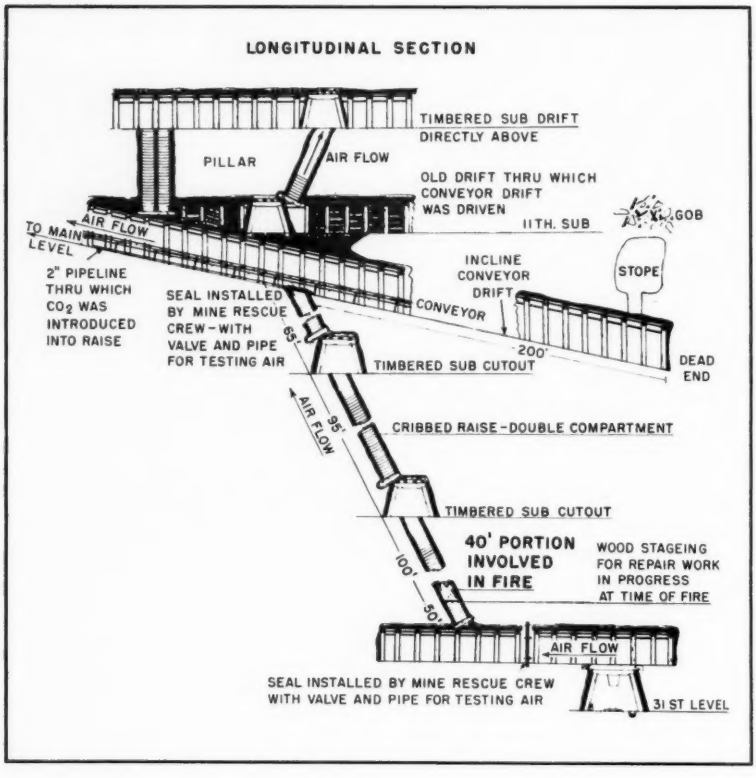
Fire Area Located and Sealed Off

Figure 1 is a schematic view of the fire area. The fire occurred in the 300-ft double-compartment, cribbed raise connecting the 29th and 31st Levels. At the bottom of the raise just above the 31st Level is a top loading sub. These subs shown here are merely cut-outs; they are not driven to any extent. The top of the raise is located in the inclined conveyor drift, which was driven through an old drift, as shown, to the 29th Level. In order to drive the conveyor drift through the 11th Sub, or the old drift as shown here, it was necessary to block the back with 18 feet of lagging and timber. With these conditions, you can readily see that a very serious situation would have existed had the fire broken out on the incline. The east end of the conveyor drift is dead-ended, with a stope opening up above and into the old gob. Here again, you can appreciate the seriousness of the situation had the fire broken out on the conveyor drift. The 30-in. belt shown in Figure 1 is installed directly above the top of the raise, with a clearance of about one ft. This presented a tough problem when it came to sealing off the raise.

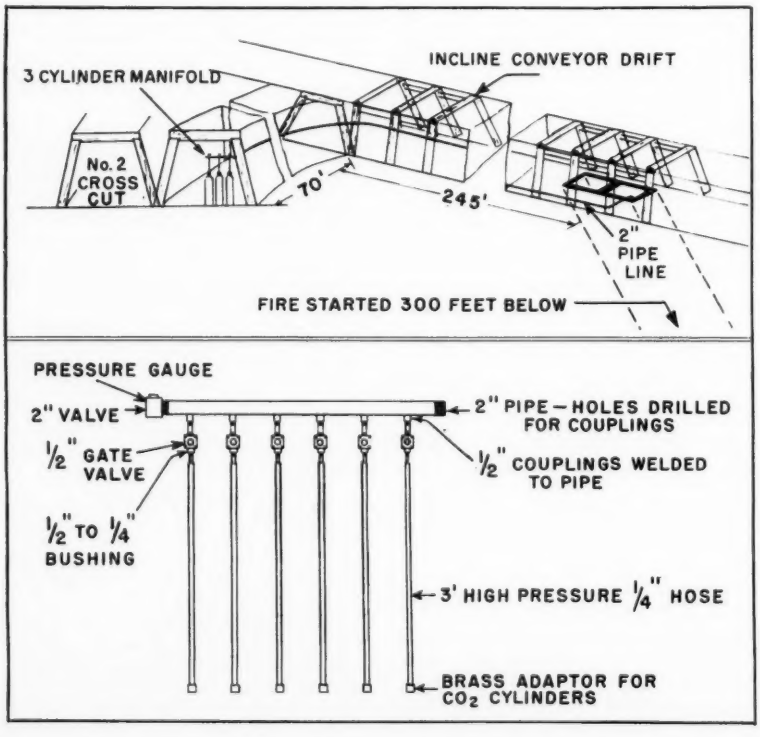
The fire was located about 50 ft above the loading sub in this raise and was started by the careless use of a cutting torch. Under normal conditions, there are approximately 20,000 cfm passing from the 31st Level through the raise to the 29th Level. Due to the fact that a crew was repairing the bottom of the raise, the top was covered with plank, which cut down the air flow considerably. After the fire was detected, the air doors on the 31st Level were closed and the fans shut down, which further reduced the air flow through the raise.

It was fortunate that a maintenance man came by early on the midnight shift and smelled smoke and that a full mine rescue crew was available from the afternoon shift crew. The first project to get started after the men were taken out of the mine (there were 35 working on the night shift) and after the fans and air doors were closed, was to start construction of the seal on the top loading sub above the 31st Level. Additional apparatus crews were called out and work was started underneath the conveyor belt to improve the seal over the top of the raise and to get water flowing into it.

Needless to say, there was a roaring inferno in this 300-ft chimney. The smoke was dense in the inclined conveyor drift and in the top loading sub above the level at the bottom and the apparatus crews were working in an atmosphere which contained over one-tenth of one percent carbon monoxide. Now you may recall that two-hundredths of one percent, or two parts in ten thousand, will create a terrific headache and prolonged



The fire started near the bottom of the 300-ft cribbed raise in the sketch above. CO_2 cylinders and manifold connected to 2-in. air line leading to the raise are shown below along with details of the manifold made at the mine shop



breathing in this atmosphere creates nausea. One-tenth of one percent CO will cause unconsciousness in half an hour. Over one-tenth of one percent carbon monoxide can be fatal almost instantaneously. During the course of the fire, there were some 30 men working under oxygen and every precaution had to be taken due to the high content of carbon monoxide. The heat in the incline at the top of the raise was terrific, causing concern as to the possibility of the planking and brattice cloth in the seal over the top of the raise catching fire.

The use of CO_2 seemed indicated since time was so important and other methods so difficult. A supply of liquid in 50-lb cylinders was ordered as well as a ton of dry ice, leaving a wide margin of safety compared with the estimated volume of 18,000 to 20,000 cu ft involved in the raise and cutouts.

It soon developed that obtaining either dry ice or liquid CO_2 in quantity presented a problem since ordinarily dealers in the vicinity do not carry large stocks. However, through the efforts of the Standard Service and Supply Co. at Iron Mountain, 100 cylinders, the equivalent of approximately 40,000 cu ft of gas, were rounded up from his various retail customers. These were trucked in and delivered early in the afternoon. The dry ice was finally located in Minneapolis through the Liquid Carbonic Corp. and dispatched via special truck to the mine, arriving the same afternoon. One-hundred additional cylinders of liquid were located in Milwaukee, to be delivered the following morning.

CO_2 Introduced in Air Line

Introducing the CO_2 gas and later the dry ice into the raise was the next problem to be considered. Since CO_2 is heavier than air, it seemed reasonable to introduce it at the top of the raise. However, this meant prolonged work on the part of the apparatus crews in very dangerous conditions due to the heavy smoke and heat around the top of the raise. This situation prompted our first experimental gamble.

In spite of being warned against the use of the mine piping system, it was decided to introduce the CO_2 gas from surface through the main air line. Every precaution was taken to keep the cylinders upright to avoid getting any liquid into the lines. The manifold as shown was later augmented with a second, handling three additional cylinders, or a total of nine in all. This construction was deliberate, since it was anticipated that later it would be desirable to continue introducing small quantities of CO_2 directly from No. 2 Cross-cut. A manifold such as this requires special fittings for the CO_2 cylinders since the several available bottled gases are equipped with different threads to in-

sure against mistakes, such as introducing oxygen into a fire, or acetylene into a brewery.

The exhausting of the gas into the manifold was so timed to keep the line under constant pressure and at no time to completely exhaust all nine cylinders at the same time.

Still working under apparatus in dense smoke and heat, a crew broke the air line at the top of the raise in the inclined drift and connected it to a 2-in. pipe which had been driven down through the seal at the top of the raise. The necessary valves in the shaft and along the levels were closed to form a direct line from the shop to the top of the raise. The line was purged of air, first through a bleeder at the receiver by-pass not far from the collar of the shaft, and later at the point where No. 2 Cross-cut leaves the main level drift. It was estimated that the contents of two or three cylinders were used in purging more than 5,000 ft of line composed of various lengths of 6-in., 4-in., and 2-in. pipe. Once the cylinders had been connected to the manifold, this purging took a matter of minutes.

In all, there was a lapse of approximately 18 hours from the time the fire was first detected until arrangements were completed for the introduction of the carbon dioxide gas under pressure through the seal and into the top of the raise.

Explosion of Dry Ice Anticipated

Meanwhile, a fairly air-tight seal had been completed on the top loading sub above the 31st and as effective a seal as possible had been constructed at the top of the raise. This latter seal leaked badly, permitting the fire to continue at an almost uninterrupted pace, drawing its oxygen from the top.

The original plan involved the introduction of considerable amounts of CO_2 gas into the top of the raise prior to the next gamble—which was the introduction of dry ice. It was anticipated that the ice would sublimate rapidly enough to constitute an explosion when the cakes encountered the high temperatures in the fire area. At normal temperatures and atmospheric pressure, a pound of dry ice produces approximately 9 cu ft of gas. At 1600 degrees F. (estimated), the conversion rate has been calculated at approximately 24 cu ft per pound, an action which takes place almost instantaneously. Obviously, it was prudent to attempt to cool off the area with gas prior to the introduction of the ice. This was done but not to the extent originally planned, since by that time everyone was anxious to get on with it; 18 hours without sleep under constant pressure is apt to affect conservative judgment.

After the introduction of some 4000 cu ft of gas, it was decided to try a relatively small quantity of ice, which had to be dumped down an opening in the top seal. Six blocks, which were originally 58 lb apiece when packed and which certainly were still in excess of 50 lb, were dumped down through the emergency opening. The reaction was terrific. Smoke billowed out of the top of the raise and drove the apparatus crew back up the incline to the fresh air base. After checking to see that everyone was all right, the apparatus crew went back to the fire area to find out what had happened. Returning to the top of the raise, they found the smoke to be clearing out and very little coming up the raise through the opening. They dumped the balance, one ton, of dry ice down the raise, closed the seal and returned to the fresh air base. In the meantime, the introduction of carbon dioxide gas from the shop on surface was continued as rapidly as possible and connection of cylinders to the manifold was staggered to insure a continuous flow. It was realized, however, that the flow would have to be decreased if the first 100 cylinders were to last until the remainder of the order arrived the following day. The rate of introduction of carbon dioxide was, therefore, reduced.

F. J. Haller, in his long mining experience has, on a number of occasions, had to personally lead fire-fighting crews. A mining engineering graduate and experienced operator, he was superintendent of the famous Mather Mine during its construction and development stages and later was manager of the Michigan mining operations of the Cleveland-Cliffs Iron Co. Haller joined North Range Mining Co. as vice-president four years ago.

His co-author, F. G. Michels, has also had extended experience with mine fires. After several years of selling mine safety equipment, he became safety director for North Range Mining Co. in 1949. In this position he had considerable previous experience on mine rescue crews fighting underground fires.

Fire Under Control

About three hours after the CO_2 had first been introduced, an inspection revealed the visibility in the inclined drift to be good. The carbon monoxide content above the poorly constructed seal at the top of the raise was down to two-hundredths of one percent. Inspection at the bottom of the raise in the top loading sub revealed that the carbon monoxide content was down to the point that breathing apparatus was unnecessary. Water running down the foot side of the raise and coming out of the pipes through the seal was tepid instead of very hot as it had been previous to the introduction of the carbon dioxide. This indicated that the fire was well under control. It was then decided to start the fans and ventilate the mine, taking periodic checks for carbon monoxide at the top and bottom of the raise and also in other areas of the mine. A flame safety lamp was hung at the top and at the bottom of the raise to detect any appreciable volumes of carbon dioxide gas escaping. However, CO_2 is readily absorbed in water and carried away, and with the dissipation of the gas by the ventilation fans, there were no indications of carbon dioxide pockets.

Operation Resumed—Cautiously

It was decided that if no change occurred within the next few hours, a section of the manifold would be connected to the air line at the top of the inclined drift and the balance of the CO_2 would be introduced into the fire area from that location. This would permit restoration of the air lines and resumption of mining operations in all working places, with the exception of those on the east end of the inclined conveyor drift. By 7:00 a.m. the following morning, samples taken from behind the seal at the top of the raise showed a content of two-hundredths of one percent carbon monoxide. Samples taken from behind the seal at the bottom of the raise were negligible. The only other location where carbon monoxide was detected that morning was the dead-end stope area at the end of the conveyor belt where readings ranged from one-hundredth of one percent to eight-thousandths of one percent, practically negligible.

The very low carbon monoxide content in the fire area indicated with practical certainty that the fire was out. However, with little to gain and much to lose, the cautious approach was continued in that CO_2 gas was introduced into the raise for an additional 24 hours and it was kept sealed for three days. At that time the raise was opened and inspected and it was found that the fire *was* completely out.

The use of CO_2 permitted almost immediate control and extinguishing of a fire (in 24 hours or less) which could have caused a shutdown for weeks—months—who knows just how long. The introduction of carbon dioxide gas through the air line from surface was an untried method on which we gambled. It worked successfully and saved hours of precious time. The use of dry ice was a new venture in underground fire fighting. Caution must be used when introducing dry ice into a confined fire area because of the terrific rate of sublimation. However, this effect proved very beneficial in causing an almost instantaneous expulsion of oxygen and producing a rapid cooling effect which eliminated two of the components of fire, leaving the third, the combustible material, inactive.

CONTINUOUS MINING in Various Seam Conditions

By WILLIAM LAIRD
Superintendent, Federal Mine
Eastern Gas & Fuel Associates

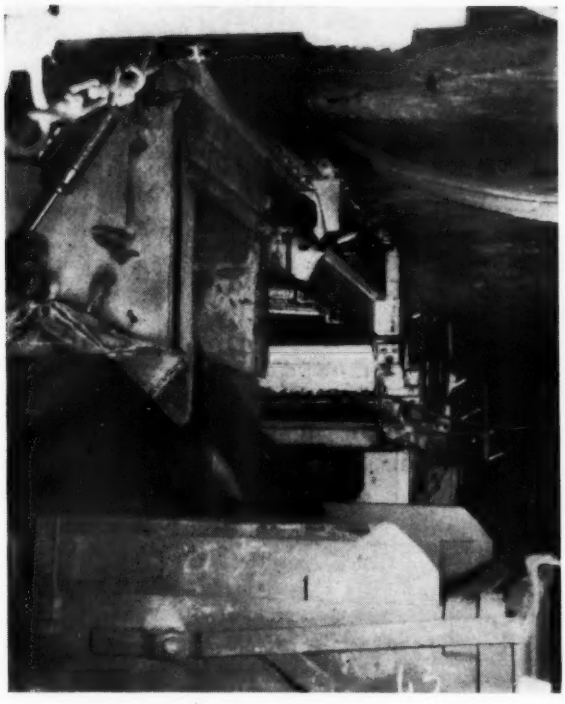
The author describes: typical coal seam conditions, plan of mining, characteristics of the Goodman continuous mining machine, transportation of coal from the continuous unit to the mine car, screen analysis, ventilation, roof bolting and general conditions encountered in the employment of continuous mining equipment in the Pittsburgh seam of coal at Federal No. 1 mine

FEDERAL No. 1 mine at Grant Town, W. Va., has one Goodman 500 and four Goodman 400 continuous machines. One 500 was placed in service on June 17, 1954, and has mined 574,293 tons of coal to date. The first 400 was placed in service on December 21, 1955, and has mined 294,606 tons of coal. It has not been necessary to overhaul any of these continuous machines to date.

Some Difficult Seam Conditions Encountered

The seam mined is the Pittsburgh. Using a typical coal section for an example, mining height is 78.25 in., leaving 12½ in. of top coal and 2½ in. of bottom coal. The top coal is left because of coal impurities and, mainly, to support a very friable top. The bottom coal is left to delete impurities and keep the machine out of a friable bottom. The characteristic Pittsburgh seam parting averages five to six in. of slate, coal and slate, and the occasional two to three-in. thick pyrite lenses. Clay veins, slips,

Successful roof control on the continuous mining section can be attributed to the arch roof cut by the Goodman continuous machine, limited open area, absence of blasting and speed of extraction



This view of the coal being loaded into the mine car shows the head room required and the structure supporting the belt drive

sandy shale faults and massive sulphur balls have been encountered in this relatively flat seam of coal, causing problems, some of which are answered promptly, while others are never answered.

On one butt entry 60 different inclusions were encountered within a distance of 1800 ft and that does not include a 175-ft fault. The 1850 ft of entry and 650 ft of bleeder entry required 28.33 work days to drive. There were 25,386 tons of clean coal produced. A total of 2885 bits were used, costing 11.4 cents per ton.

Mining Plan for Development and Production

The present plan of mining and sequence of operation came through study and experience. Three entries are driven on 72 and 78-ft centers. Breakthroughs are driven on an angle of 60° and staggered by a distance of 30 ft. Breakthrough centers measured along the center line of the entry are 83.1 ft. Management has standardized on a 166-ft belt advance or retreat, whichever the case may be. Our rolls of belting are purchased in lengths of 332 ft.

The continuous machine drives the No. 2 entry approximately 30 ft, then drops back and drives a breakthrough to the right into No. 3 entry and drives No. 3 entry a distance of approximately 85 ft. The unit is then retreated back through the breakthrough to its initial starting point in No. 2 entry where phase two is started. The machine drives approximately 55 ft in No. 2 entry, then drops back and drives a breakthrough left into No. 1 entry and continues on driving No. 1 entry approximately 85 ft. This procedure is repeated again on the right and on the left. Four phases complete the cycle and provides enough room for the belt to be extended.

When the butt entry development is completed, rooms are driven on 83.1-ft centers. The rooms are driven 46 ft on an angle of 60° and then turned 90° to the entry and driven a distance of 280 ft. Following are the dimensions and sequences in which the rooms are driven.

Room No. 1 is driven a distance of 80 ft and designated phase one. The continuous machine is retreated out of room No. 1 to room No. 2 where phase two begins. Room No. 2 is driven approximately 65 ft; then the unit is pulled back about 25 ft to drive a breakthrough to No. 1 room. No. 1 room is then driven approximately 85 ft. The machine is moved back into room No. 2 where phase 3 is started. Here again the continuous unit drives No. 2 room beyond the second breakthrough, then drops back and drives the second breakthrough to the right into No. 1 room. No. 1 room is then extended a distance of approximately 85 ft. The continuous machine is again retreated to No. 2 room where phase 4 and phase 5 are completed. It should be noted that commencing with No. 4 room only four phases are necessary to complete the cycle for driving the remaining rooms.

The room development completed, room pillars are extracted by driving three lifts 95.96 ft long per pillar, leaving a four to five ft fender between each lift. These fenders provide protection for the men and

In this arrangement used to supply power for the face equipment, the box in the center foreground is the Ensign M-800 distribution box for the continuous machine only. The four Miller plugs are used to supply power from 1,950,000 CM aluminum feeder cables to the two shuttle cars, loading machine and Fletcher drill. The 400 and 500-kw rectifiers never exceed a distance of 3500 ft from the mining equipment

equipment, minimizing danger of roof falls on the equipment, thereby increasing efficiency and maintaining production.

A typical continuous machine butt entry is 2600-ft long. Rooms are driven off No. 3 entry or the right side of the butt entry. Room pillar lifts are driven parallel to the rooms, permitting the operator to remain in the clear and on the solid side while operating the machine. This unit does not have dual controls yet and the control equipment on the machine is located on the right side. The change from rooms driven on 60° to rooms driven at 90° resulted in an improvement in coal recovery.

Production, Equipment and Section Crew

Eighteen butt left had a life of 119⅔ days, and 179,274 tons of coal were produced from it. This is an average of 1498 tons of coal per day, 499 tons per shift and 60.7 tons per man. A total of 3315 bits were used at a cost of $0.02 per ton.

Our continuous mining sections are equipped with the following:

1—Goodman continuous machine
1—Joy 11-BU loading machine
2—Joy 10-SC shuttle cars
1—Joy 42-D shuttle car (supplies and rock dusting)
1—Goodman type 97HC-30-in. belt, 50-hp drive motor or a rope belt -93T, 36 in., 30/60 hp drive motor
1—Fletcher roof bolt drill
1—Square D fused safety switch distribution box
1—Ensign M-800 distribution box for continuous machine only
1—Hydraulic car spotter
1—MCM copper or its equivalent aluminum feeder track and two-in. spray water pipe and fittings

Section crews consist of the following:

1—Section foreman
1—Continuous machine operator
1—Loading machine operator
2—Shuttle care operators
1—Utility man (brattice, etc.)
1—Mechanic
1—Boom man
2—Roof bolters (one shift only)

A comparative screen analysis of the coal mined by the 400 and 500 continuous machines and our conventional mining equipment is shown on this page.

Hard coal when mined with continuous miners produce a much higher percentage of lump and slack sizes and a low percentage of the intermediate or stoker sized coal.

Roof Conditions Favorable

Our roof bolt plan consists of one row of ⅝ in. diameter by five-ft bolts on, not to exceed five-ft centers, to be installed in the middle of all three entries, breakthroughs and around the first room pillar of every room. It should also be noted that additional bolts are installed at wide intersections. All roof bolts are countersunk where rooms and pillar lifts are to be made.

All roof bolts are countersunk where rooms and pillar lifts are to be made

Successful roof control on our continuous mining section can be attributed to the following:

(1) Arch roof cut by the Goodman machine
(2) Limited open area
(3) Absence of blasting
(4) Speed of extraction

Size (in.)	Goodman 500 Solid	Goodman 500 Pillar	Goodman 400 Solid	Goodman 400 Pillar	Conventional Mining
5 x 1¼ (egg)	38.0%	37.2%	34.5%	38.5%	29.7%
1¼ x ⅜ (stoker)	23.4%	33.0%	26.2%	32.7%	36.1%
⅜ x 0 (slack)	38.6%	29.8%	39.3%	28.8%	34.2%

A continuous mining section is equipped with two Joy 10-SC shuttle cars for transporting coal and one Joy 42-D shuttle car for supplies and rock dusting

Machine Sampling From a Conveyor Belt

By A. H. BLYTH
Mechanical Engineer, Marcona Mining Co.

A. H. Blyth received his degree in mechanical engineering from the University of Leeds, England. He has traveled extensively in Africa and India. In Pakistan, he was executive engineer of the Lower Sind Barrage hydroelectrical project. In 1953 he went to Peru as representative for the Caterpillar Tractor Co. and joined the Marcona Mining Co. in his present capacity in 1955.

ACCORDING to Taggart, sampling is the operation of removing a part, convenient in size for testing, from a parent lot which is of much greater bulk, in such a way that the proportion and distribution of the quality to be tested are the same in both the whole and the part removed.

A more stringent definition is that the sample shall be completely representative of the whole in all respects, save in that of bulk, but present day theory is, in rudimentary form, applicable only to highly idealized technique. Perfect sampling technique is assumed to yield samples such that any deviation from complete representation of the quality to be tested in the sample are ascribed to chance causes.

Various Sampling Methods Studied, Tried

When Marcona Mining Co. commenced operations in Peru, the relative merits of various methods of sampling were studied with a view to establishing a sampling process for the shiploading and sales programs. Grab sampling seemed to be the most convenient method to employ. In grab sampling, the personal element enters so largely that accurate results are difficult to obtain. It is also assumed that the character of the ore does not change with depth in the heap. Correct results can hardly be expected on such an assumption, on account of segregation. Then again, it is difficult when taking a small portion such as a shovelful or scoopful, to get full representation of all sizes of particles, especially when lumps are present. Just what part of a lump, or how much of the coarser and finer pieces, should be taken at each grab is left to the judgment of the sampler and either by over-zeal, or by carelessness, more of some size than is proper is almost certain to be taken. It is also practically impossible to take such an amount of material at each grab that every part of the lot shall have proportional representation in the final sample. Thus grab sampling was considered unsatisfactory.

A modified method which eliminated most of the disadvantages of regular grab sampling was then tried. This method entailed the stopping of the shiploading conveyor belt every 500 tons, as registered by the weightometers, and cutting a sample by shovel, approximately two ft wide, transversely across the belt, ensuring that the belt was completely cleaned in this sampling area. Fall-in of the part already cut takes place and this has some bearing on the validity of the sample, but in spite of this, the superiority of this method over grab sampling is obvious.

However, these improvements were not gained without a price. The conveyor had to be stopped for every sample. This delayed shiploading. Then, restarting the system in a loaded condition led to all manner of electrical and mechanical fatigue and breakage. Furthermore, the belt was subjected to all kinds of stress, slippage, excessive stretch, etc., with subsequent internal breakdown and shorter life.

The samples removed by stopping the belt had proven to be accurate; our analyses had always compared favorably with the outturn as recorded by the buyer. In view of this similarity, it seemed logical to attempt to develop a machine which would:

(1) Remove mechanically, a sample which was similar in all aspects to the current sample being taken by hand.

(2) Carry out this sample-taking on the move and thus avoid the necessity for stopping the conveyor system each time a sample was required.

(3) The machine had to make use of as many existing facilities as possible, and become an addition, rather than a modification, to the plant. The only time available for installation was during the slack time between ships, any stoppage of shiploading being out of the question.

By achieving these three aims, a mechanical device would completely eliminate the personal element, which is possibly the weakest factor in any sampling technique, to the general betterment of the entire sampling process.

Experimental Model Designed and Built

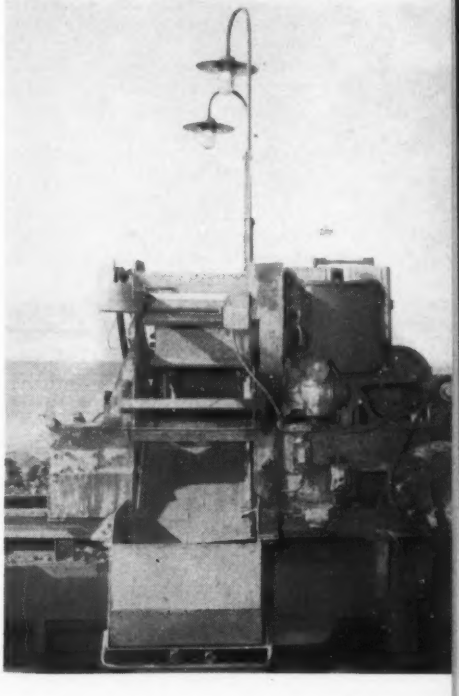
The existing facilities in the Port of San Juan, which is the loading center for Marcona's operations, are conventional, and are as seen in many other loading ports.

Travel rails are mounted on each side of the 42-in. pier conveyor, which act as tracks for the movable gantry. It was visualized that a car could be constructed to straddle the conveyor, using these rails as tracks. The car would also move at the same speed as the belt. During this movement some form of scoop or blade device would move transversely across the belt, removing a sample of ore in the process.

At the outset many problems were apparent, and the logical approach was to design and build an experimental model, which was feasible on paper, and then to use cut and try methods should any particular part fail to carry out its proposed function.

Basically, the sampling machine consists of a four-wheeled car, the wheels having single flanges spaced gauge-wise to suit the existing rails on the conveyor system. These wheels are carried in side frames, with the

Since the sampling machine was introduced, some 250 shiploads of ore have been sampled. Former overload conditions, prevalent with hand sampling, have been eliminated entirely, with definite savings in downtime.



superstructure mounted on top of the frames.

The drive mechanism is conventional, consisting of ten-hp electric motor, which, through a 3:1 Vee belt reduction, drives a countershaft. This, in turn, using chains and sprockets, transmits power to the rear wheels. It was considered necessary to employ an equalized drive to avoid any see-saw action during travel. The driving pulley on the motor shaft is so made that the Vee belt pitch diameters may be changed, and thus incorporates a speed adjustment to compensate for any slight changes of speed necessary to assure exact synchronization with the belt. A suitable control panel for the motor is also arranged on the superstructure and in front of this a comfortable seat.

The seat was incorporated so that it was possible to operate the car manually and, at the same time, observe the actual sampling operation while the machine was in motion.

To ensure that the ore-removing portion of the machine accurately follows the profile of a loaded belt, the roller guides in the superstructure have a similar profile. These guides carry four substantial crossshafts which are linked together in chain form, with suitable rollers mounted on the shaft extremeties—the whole forming an articulated assembly which can be pulled across the belt. Due clearance has been made in the superstructure to allow the loaded belt to pass under the machine.

Roller chains were considered superior to wire rope for the operation of pulling the articulated assembly back and forth in the profiled guides, inasmuch as the pull on each side would be equalized and slippage would be avoided.

This assembly is moved by a 2½-hp gearmotor with a suitable reduction. The train moves at 25 fpm and forward and reverse travel is restricted by electrical limit switches.

The electrical take-off for the car is common to the conveyor electrical supply, so that any frequency change affects both the car and the belt simultaneously and there is no irregular movement between them.

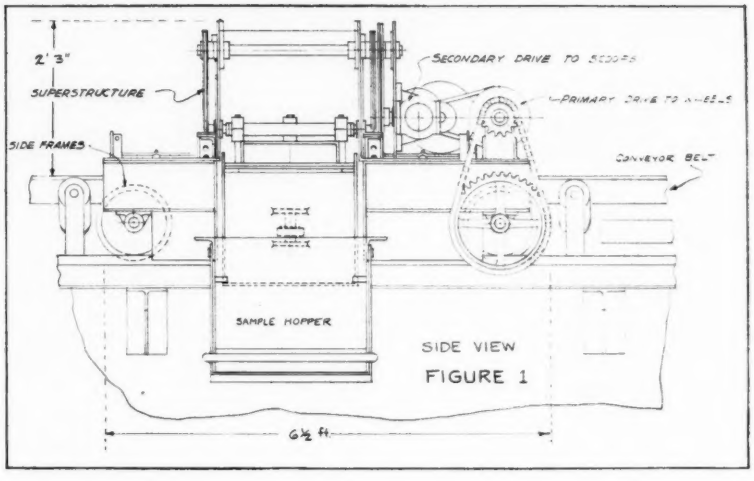


FIGURE 1

Figures 1 and 2 are side and end views of sampling machine, while Figure 3 shows the length of run required.

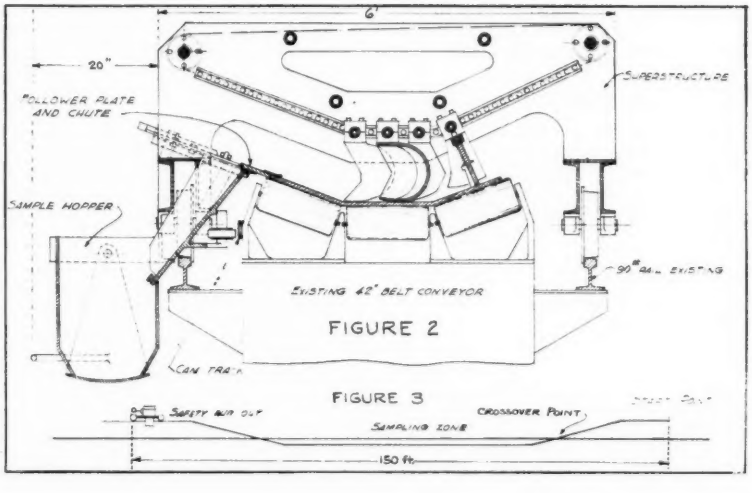


FIGURE 2

FIGURE 3

Action of Scoops

After a good deal of trial and error, the following combination of scoops proved most successful.

The leading shaft of the articulated train carries a pair of ore-breaking tines, which are spaced equal to the required width of cut. The primary object of these tines is to break up the keying of the ore, and by so doing, facilitate the action of the second scoop in the train.

It is feasible to assume that when the breaker tines pass through the ore, an equalizing split takes place. In some cases, as when the tine encounters a lump, this lump is deflected to the outside of the cut and is not removed, while in other cases the lump is deflected inwards and is removed as part of the sample. Therefore, in addition to breaking up the keying effect of the ore, the leading tines also classify which part of the ore is to be taken as a sample.

The second scoop is made semicircular in cross section, and may be likened to a road-grader moldboard. The desired action of this scoop is to lift and roll the ore off the belt, rather than attempt to bodily push it off.

The third and final member of the train is merely a springloaded brush which sweeps off the remaining fines and leaves the belt clean.

To prevent fall-in of the cut, the scoops on the machine were fitted with telescoping side plates.

In all conveyor installations, the carrier rollers are wider than the belt, to allow for the belt drift. The car had not only to make contact with the belt, but also had to clear the carriers. To avoid spillage in the gap between the edge of the belt and the outer faces of the rollers, a spring-loaded follower plate was fitted. This was inclined at the same angle as the angled rollers. It was, in effect, an extension of the belt and formed a bridge up which the ore could be swept on its way to the sample container. The container is in line with the scoops and is integral with the car.

To provide an initial start for the

car, the tracks were elevated at the starting end of the sampling run. This ramp assists take-off and enables the car to reach belt speed in a shorter time, thus cutting down the length of the sampling run required. Also, by causing the car to be elevated, ample space becomes available for the scoops to clear the loaded belt when being retracted to their original position, ready for subsequent samplings.

A similar ramp was provided at the terminal of the sampling run. This acts as a safety run-out and disengages the scoops should they become inoperative while in engagement with the ore on the belt.

The movement of the follower plate was controlled by a profiled cam track mounted inside the travel rails, in contact with a roller attached to the underside of the follower plate. In conjunction with the springs and the profile of the cam track, the follower plate moved in or out as directed.

Complete Sampling Cycle—One Minute

Possibly the best way to explain the operation of the machine is to describe an actual sampling run and readers may visualize the machine on the elevated portion of the tracks at the starting end of the sampling zone. The scoops are in the retracted position and the follower plate is pushed inwards by the springs.

On a given signal the drive motor is started and the car moves down the incline. At the crossover of the inclined and horizontal sections of the track, the follower plate is moved outwards, away from the belt, by the cam profile, and then moves inwards to abut the belt by the action of the springs. At this crossover point, the scoop motor is energized by means of a built-in timing switch and the scoops begin to move through the ore. The scoops continue moving through the ore-stream and the sample spills over the bridging follower plate into the sample hopper.

Having passed completely through, the leading tines engage extensions on the follower plate, and this is withdrawn from the belt; further movement trips a limit switch, which cuts power to the scoop and travel motors and the car comes to rest.

After a predetermined interval, the timing switch which originally started the scoop motor now starts the travel motor in reverse and the car travels back to its original starting position, complete with sample, while the conveyor continues uninterrupted.

On reaching the initial inclined section, the car trips a travel limit switch and comes to rest, the incline acting as a brake. The sample is then removed and processed and the scoops are retracted manually, ready for reuse.

This, then, is a complete sampling cycle, which needs approximately 150 ft of track and the operation takes place in approximately one minute.

The electrical take-off for the car is common to the conveyor electrical supply, so that any frequency change affects both the car and the belt simultaneously and there is no irregular movement between them.

Final Tests and Acceptance

Having made a machine which now worked satisfactorily, from a mechanical standpoint, further tests were necessary to see whether the samples obtained by the machine were a true reflection of the bulk being sampled.

This was done by making a series of tests on different types of ore, over complete shiploads. Hand and machine samples were taken as closely together as possible, and then by comparing the two samples, the relative merits of each were assessed.

Several shiploads were sampled and the results obtained are tabulated below:

	Hand sampling	Machine sampling
20,000-ton shipment of blast furnace ore		
Moisture	1.2	1.2
3/16 mesh	20.2	20.8
Fe	60.5	60.3
S	0.203	0.204
15,000-ton shipment of blast furnace ore (lower percentage of fines)		
Moisture	0.8	0.8
3/16 mesh	10.2	10.6
Fe	61.7	61.5
S	0.143	0.138
24,000 tons of fines		
Moisture	1.9	1.8
10 mesh	63.5	64.2
Fe	56.2	56.4
S	0.451	0.485

Two very significant facts show up in these figures:

(1) When sampling blast furnace ore, the fines content is higher and the iron content is lower, in machine obtained samples.

(2) When sampling fines the situation is somewhat reversed, i.e., the iron content is higher.

These slight differences may be explained as follows:

When handling ore on conveyor belts, it is considered good practice to cushion the impact of the lumpy material by means of a bed of finer material. This is largely taken care of by the trajectory of the material off a pulley and by chute design. Also, when transporting ore on a conveyor belt, the undulating belt imparts a jigging motion to the material and the smaller particles fill up the interstices between the larger particles.

When sampling by machine and averting fall-in, a smaller sample is actually taken. Yet this sample contains a similar amount of fines and smaller particles when compared to a hand sample taken in the same place. The characteristics of Marcona ore are such that the finer material is lower in iron content. It therefore follows that by avoiding the sweetening process which fall-in causes, the iron content is slightly lower.

When handling fines, the heavier iron bearing particles are jigged to the bottom of the stream, thus by averting the degrading process which fall-in causes, a slightly higher iron content may be expected in a machine obtained sample.

The foregoing reasoning has proved consistent with further tests and it was concluded that the machine gave a truer sample.

Conclusions

Since the sampling machine was introduced, some 250 shiploads of ore have been sampled. Some minor changes have been made, but the machine remains substantially the same.

Former overload conditions, prevalent with hand sampling, have been eliminated entirely, with very definite savings in downtime.

Shiploading times have been reduced approximately ten percent.

It has not been possible to calculate the savings due to elimination of unfair wear and tear but in any case these must be quite considerable.

In general, the sampling procedure shows an all round improvement and a feeling of confidence prevails when sampling and sampling techniques are discussed in Marcona.

ANCHORAGE CHARACTERISTICS OF ROOF BOLTS

By LOUIS A. PANEK
U. S. Bureau of Mines

A discussion of ways and means to measure ability of roof bolts to support mine roof and what these measurements mean

TO choose a roof bolt appropriate to his specific roof conditions and to design a roof bolting system, the engineer must know what load can be supported by such a bolt. Each type of bolt assembly has inherent load limitations that depend on bolt diameter, anchoring methods, etc. Further load limitations may be imposed by the capacity of the roof rock to provide anchorage. Enough experimental testing of roof bolts has been done to establish the inherent load limits; but, since the effectiveness of a bolt depends also on the rock, which is known to be quite variable, tests must be made of bolts installed under actual mine conditions in order to evaluate their overall anchorage capacity.

The earliest test of load-supporting capacity consisted of determining the load at which a bolt could be "pulled out." This procedure gave inconclusive results; hence, a more precise delineation of bolt and shell behavior during test had to be developed, which necessarily entailed investigation into what may be termed the anchorage characteristics of roof bolts. In the light of this knowledge it is now possible (1) to state that the most effective bolt assembly (bolt and wedge or bolt and expansion shell) is one that offers maximum load resistance with minimum displacement, and (2) to specify a test, simple to execute and to interpret, by means of which the overall anchorage capacity can be evaluated. The discussion that follows centers around the implications contained in the preceding statement.

Significance of Head Displacement

Ultimate function of a roof bolt is to minimize roof deflection. Any factor, such as anchor slippage, that contributes to head displacement (downward displacement of the lower end of the bolt, whether or not the bolt is of the headed type), also tends to weaken the roof because head displacement is equivalent to roof deflection. That is, apart from roof that is so weak as to fall from between the bolts, the roof can deflect only to the extent that the head end of the bolt moves down. It is pertinent, therefore, to inquire as to the nature and source of the head displacement that occurs when load is applied to a bolt anchored in a mine roof (Figure 1).

Overall anchorage characteristics (bolt, anchor and rock) can be presented as a graph of head displacement (measured by a dial gage) vs. bolt load (applied by a hydraulic jack). Head displacement H is the sum of two components, bolt elongation B and anchor displacement A (Figure 2). By anchor displacement is meant the displacement of the upper end of the bolt with respect to the anchorage horizon, which may arise from slipping of the bolt prongs or expansion shell along the sides of the hole, local flow or yield of the rock due to pressure created by the anchor, downward movement of the plug in the shell, or some combination thereof. This statement is explanatory only—the mining engineer need not distinguish between these subcomponents for he has no control over them beyond choosing the hole diameter, the rock and the bolt assembly.

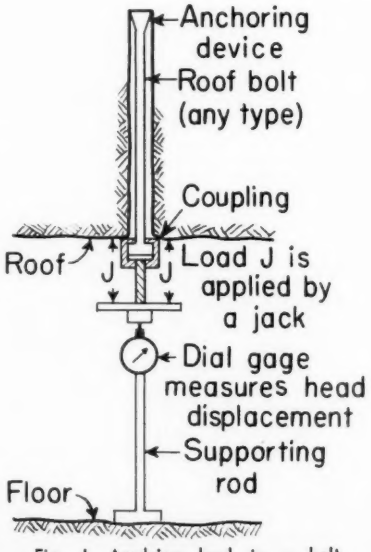


Fig. 1—Applying load to a bolt anchored in mine roof to determine its head-displacement graph

For firm rock the graph of head displacement is more or less linear at loads less than overall anchorage capacity C; in fact, the latter is chosen by inspection to be that load beyond which the graph tends to flatten out, owing to an increasingly larger increment of head displacement for each additional increment of load (that is, the head end of the bolt begins to "move"). The head displacement graph may flatten out when the bolt yields, as in figure 2a, or, at a lower load, when the anchor (1) rock plus plug or prongs, as explained above) yields, as in figure 2b. The maximum possible value of overall anchorage capacity is the yield load of the bolt.

Evaluating Anchorage Performance

To properly evaluate bolt anchorage performance from a graph of head displacement vs. bolt load, one must consider the nature and magnitude of the loading that the bolt may be subjected to in the course of mining operations. If the bolt load tends to remain constant after the bolt is installed, the overall anchorage capacity is the important characteristic, because it limits the load that the bolt can carry. In general, the lower the anchorage capacity the more bolts

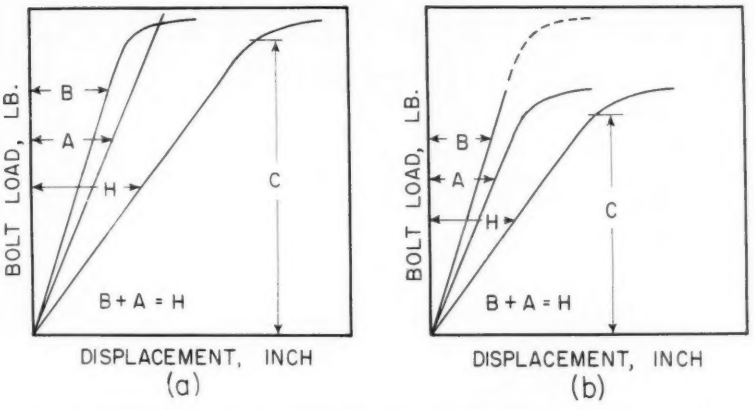


Fig. 2—Bolthead displacement graphs H showing components of displacement due to bolt elongation B and anchor displacement A. Overall anchorage capacity C is reached (a) when the bolt yields or (b) when the anchor yields

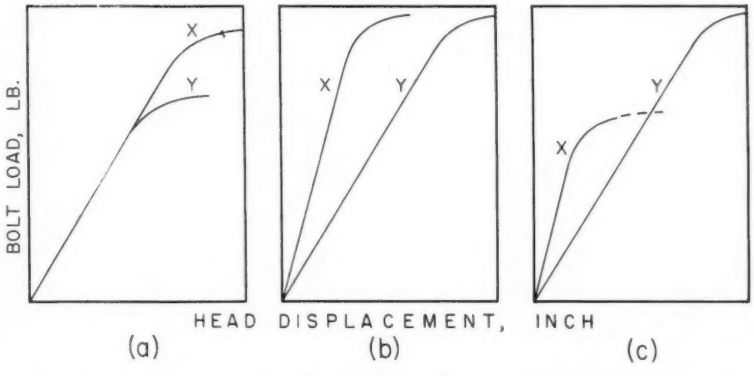


Fig. 3—Comparative evaluation of anchorage performance from graphs of bolthead displacement

must be installed per unit of roof area to achieve a given reinforcement; hence, the higher the overall anchorage capacity the better. For loads less than the overall anchorage capacity, the slope of the linear part of the head displacement graph has no influence on roof deflection because no increase in deflection can occur if the bolt load does not change.

Irrespective of cause, if the bolt load tends to increase after installation, overall anchorage capacity is particularly important as it limits the load level that can be reached before large head displacement, accompanied by large roof deflection, will begin. Also, the steeper the slope of the linear part of the head-displacement graph the smaller will be the increase in roof deflection permitted by a given increase in bolt load. This shows the merit of tensioning bolts during installation, to achieve in advance the load that may tend to be developed through subsequent roof action, apart from the advantage that results from compressing a thin-bedded roof.

Load loss, a common occurrence, probably is due to slow yield of the rock at one or both ends of the bolt, where high rock stresses exist, hence is likely to be a function of the load level and of the stress-strain properties of the rock and to be independent of the slope of the head-deflection graph. Some load loss commonly occurs during the first few days after installation, and in mines where this is a serious problem (notably those in the Pittsburgh bed) it might be profitable to determine the head-displacement graph from a test of more than the usual few minutes' duration. Finally, the higher the overall anchorage capacity the higher the bolt load that will remain after load loss has taken place.

Considering all possible loading situations, it is concluded that, for maximum supporting effectiveness (minimum roof deflection), (1) the higher the overall anchorage capacity the better and (2) the steeper the slope of the linear part of the head-deflection graph the better. Of two bolts *X* and *Y*, if their head-deflection graphs are as shown in figure 3a, *X* is better than *Y* because of its higher overall anchorage capacity. In the case represented by figure 3b, *X* is superior to *Y* because its head-displacement graph has the greater slope. For case 3c, which is not uncommon, *X* is better than *Y* for loads up to the overall anchorage capacity of *X*, but *Y* is better for higher loads; other considerations may decide which of the two is preferable for a specific application. In the absence of such information *Y* would be judged the better if its overall anchorage capacity were much the greater.

Anchorage Performance of Currently Marketed Bolt Assemblies

Inspection of typical head-displacement graphs (figure 4) reveals the inherent superiority of the one-in. slotted-type bolt over the ¾-in. and ⅝-in. expansion-type bolts. Where firm rock is available for anchorage the overall anchorage capacity is much higher for the one-in. bolt because of its greater diameter and the slope of the head-displacement graph is much greater, principally because of the absence of the downward plug displacement inherent in the functioning of an expansion shell. Furthermore, the head-displacement graph of an expansion-type bolt usually tends to flatten rather sharply at the overall anchorage capacity, which means that under conditions of increasing bolt load large roof deflection (and possibly failure) tends to occur with much less warning when the anchorage capacity is reached.

It may be well to mention at this point the ease with which the yield load of an expansion-type bolt may be exceeded by overtorquing during installation, in which case the flat part of the head-displacement graph would be reached initially. This characteristic is particularly dangerous in the case of the ⅝-in. bolt, as stress due to torquing is inversely proportional to the cube of the bolt diameter. For this reason, care should be taken not to exceed 200 ft-lb of torque when installing a ¾-in. mild-steel expansion-type bolt or 175 ft-lb for a ⅝-in. "high-strength" steel expansion-type bolt.

It may be argued that, despite its shortcomings, the expansion-type bolt is being used with apparent success to support many acres of roof—which calls attention to the truism that all roof does not require the same amount of reinforcement. For this reason, and also because the maximum safe deflection for a specific roof cannot be determined without investigation, it is impossible at present to establish minimum acceptable anchorage characteristics, except on the basis of special considerations, such as the overtorquing danger mentioned above. In these circumstances, evaluation of anchorage performance necessarily is relative—the greater the slope of the

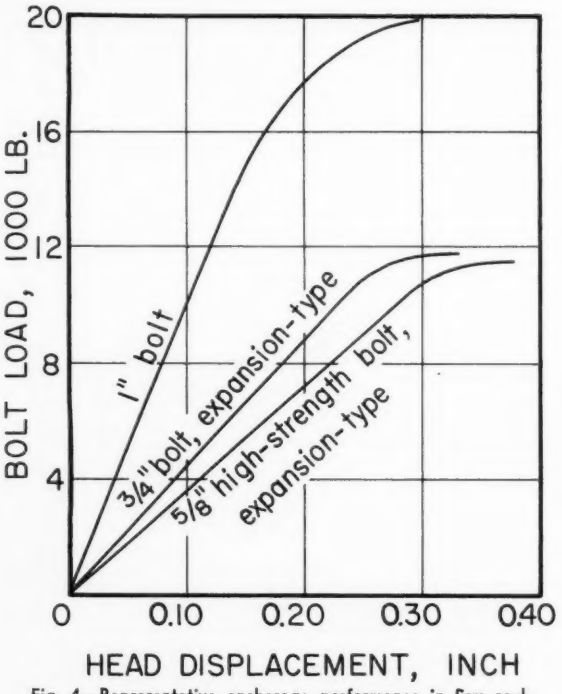


Fig. 4—Representative anchorage performance in firm rock for currently marketed bolt assemblies

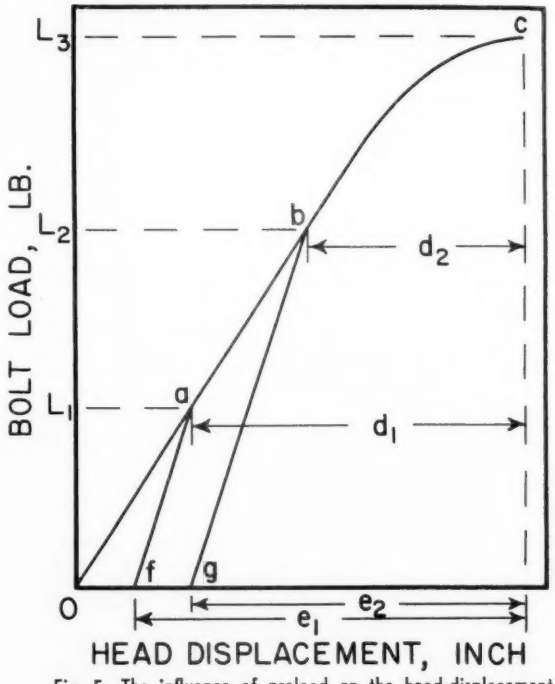


Fig. 5—The influence of preload on the head-displacement graph observed during a test

head-displacement curve and the greater the overall anchorage capacity, the better.

Reference to figure 2 shows that the maximum possible value of overall anchorage capacity is the yield load of the bolt in simple tension, which is about 20,000 lb for a one-in. mild-steel bolt, 14,000 lb for a ¾-in. mild-steel bolt, and 14,000 lb for a ⅝-in. "high-strength" steel bolt. Failure to approach the maximum value because of poor installation practice (oversize hole or overtorquing) is a waste of the paid-for strength of the bolt assembly. In ordinary roof-bolting operations, of course, no attempt should be made to *install* bolts at a load equal to this maximum value, because of the possibility of exceeding the yield load and impairing the strength of the bolts. Nevertheless, the installation should enable the bolts to *develop* the maximum possible value of overall anchorage capacity, should subsequent roof action throw more load on them.

The Influence of Preload

As has been implied, a test to evaluate effectiveness of anchorage consists of anchoring the bolt in a hole of measured diameter and measuring, with respect to the floor, the downward displacement of the lower end of the bolt as load is applied to it (since extension of the jack is generally much greater than the head displacement, measurement of the extension of the jack will give rise to erroneous results); the test is stopped when the overall anchorage capacity is determined.

Complications arise in interpreting the head-displacement graph if the bolt is pretensioned before the test. Pretensioning before testing a slotted-type bolt should be avoided, because it serves no useful purpose.

As some tension is required to anchor an expansion-type bolt, proper interpretation of the test requires that the preload be taken into account. Consider a hypothetical head-displacement graph Oabc (figure 5). If the bolt is tightened to load L_1 to set the shell, then point a is reached before the test is begun. If the test is terminated at load L_3, the bolt head-displacement graph observed during the test will be represented by *abc*, the total measured head displacement being d_1. Suppose that the test were performed instead with preload L_2; the graph obtained during test would be bc and the total measured head displacement d_2, much smaller than d_1.

Now consider the results if the pretension is released (without disturbing the plug in the expansion shell) before the test is begun. With a preload L_1 the behavior before test would be represented by *Oaf* (not *OaO*, because only a part of the head displacement at a is recovered on release of load); the graph obtained during test would be *fabc* and the total measured head displacement e_1. Under actual test conditions the break in the graph at point a might be difficult to detect. Similarly, following release of preload L_2, the graph obtained during test would be *gbc* and the total measured head displacement e_2, less than e_1.

For either procedure, whether or not the preload is released, the results would appear to indicate that higher initial torque (higher preload) produces better anchorage because less head displacement occurs during the test. It appears that this reasoning and conclusion have received some popular acceptance in the industry. The head displacement obviously has to be less by virtue of the procedure employed, yet the fundamental head-displacement graph is *Oabc*. The confusion may be eliminated simply by determining the slope of the linear part of *Oabc*, which equals (load increment) ÷ (head-displacement increment) *if all such increments are measured at loads greater than the preload.* It is advisable to report also the preload, or at least the installed torque.

One may question whether, for loads above the preload, the test graph will coincide with *Oabc* for different preloads such as L_1 and L_2. Bureau of Mines investigations bear out the thesis that, once the shell is caught in the hole, torquing the bolt to a specific load value has the same effect on the expansion plug and shell (presuming no overtorquing) as applying the same load by straight

(*Continued on page* 89)

Lifts 18 tons at a bite...

TIGER BRAND WIRE ROPE at work in the world's largest open pit mine where long service is the first requisite.

...works 24 hours a day

THERE'S NO REST for the Tiger Brand Wire Rope on this big shovel. It works continuously during the iron ore season and is subject to heavy loads, abrasion and fatigue.

Not all shovel ropes are suitable for all service requirements. Shovels vary as well as digging conditions. Therefore, shovel ropes must possess greater strength, greater abrasion and fatigue resistance. Tiger Brand Wire Rope is designed specially for these applications to give the best possible service.

To help you select the best wire rope for your equipment, call in the Tiger Brand Wire Rope Specialist. He can frequently save you money by recommending a better rope for the job.

AMERICAN STEEL & WIRE DIVISION
United States Steel, General Offices: Cleveland, Ohio
COLUMBIA-GENEVA STEEL DIVISION, SAN FRANCISCO · TENNESSEE COAL & IRON DIVISION, FAIRFIELD, ALA., SOUTHERN DISTRIBUTORS
UNITED STATES STEEL EXPORT COMPANY, NEW YORK

USS AMERICAN TIGER BRAND WIRE ROPE

Excellay Preformed

USS

UNITED STATES STEEL

MINING PHOTOGEOLOGY

By THOMAS W. MITCHAM
Mining Geologist-Consultant
Flagstaff, Ariz.

MINING photogeology is considered as a technique apart from simply mapping "geology" from aerial photographs. Specifically, fractures, other structural situations, rock-body contacts and alteration are mapped to a detail almost equivalent to that ordinarily attained in underground mapping by mining geologists. The writer believes that applications of such a technique are rare, but feels that mining photogeology will soon be treated as a separate subject with special emphasis in our universities.

Geology and mining geology are not synonymous. Neither is a geologic base map necessarily prepared to display ore-search criteria. Do not confuse photogrammetry with photogeology nor the latter with mining photogeology.

Photo-Vision Horizons

Qualified experienced mining geologists make detailed plan maps of underground workings, always mapping fractures in fine detail. Their "plan view" is limited, of course, in these narrow workings. Yet when mapping the surface, where their plan view is continuous or nearly so, they seldom map in detail, least of all the fractures. This striking contradiction is easily explained; to the unaided eye, weathering and erosion have destroyed the fine detail which can be seen so well in the "fresh" rocks underground.

A unique, complete plan view is displayed on aerial photographs. Fine details apparently destroyed by weathering and erosion are brought back in sharp focus. Fractures are often sharply etched out by drainage patterns and vegetation.

By using photographs, the geologist gains greatly in efficiency, often mapping in hours what would require weeks of field time. However, even this point is minor when compared to the geologist's great gain in power of observation. Often, trees, which would appear to be placed at random by nature (no matter how long they are observed in the field), are immediately seen to be "planted" in rows when only glancing at photographs. Brush and grass often display significant patterns. Striking lineaments of canyons which can be seen in minutes on photographs would be missed after months of field work.

With an aerial photograph in hand, the author is shown examining the Oquirrh Range preparatory to a photogeologic study. As experience indicates, new knowledge of geologic features, critical to ore localization, will be gained early in the study. Mapping by ground methods alone might not reveal many of these features.

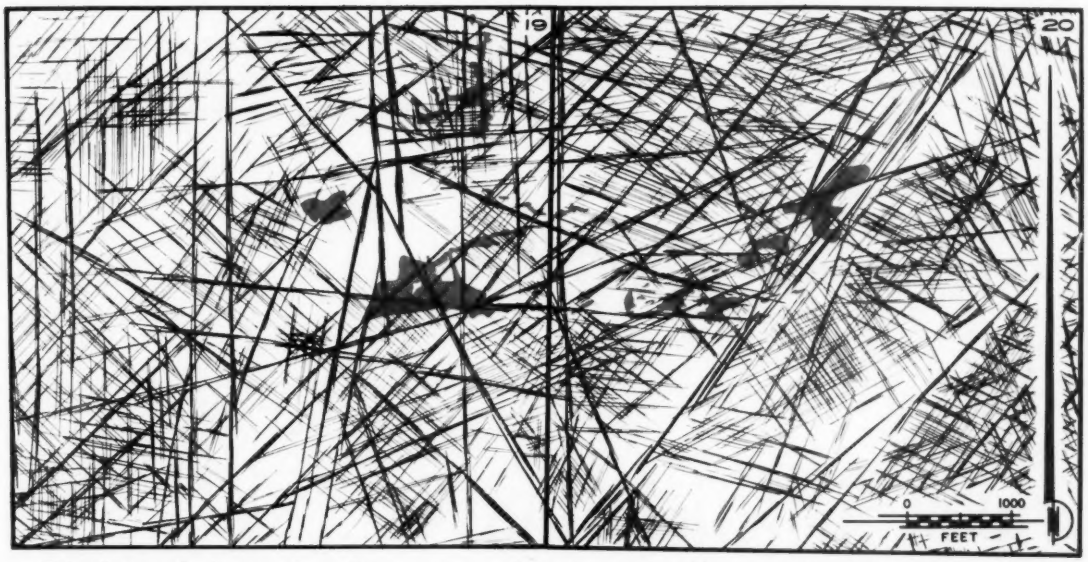
Photogeologist vs. the Foot-Soldier

The days of the geologic foot-soldier, of course, are not limited in any sense. However, the writer feels that the stress of future mining exploration, and its guiding technique, will be mining photogeology.

In no way is the above paragraph meant to imply that two divisions of mining exploration men will or should develop, i.e., the "photogeologist" and the "geologic foot-soldier." Such a trend would be unfortunate. The result would be serious coordination errors.

The photogeologist and the geologic foot-soldier, in fact, must be the same man. To his great wealth of knowledge and his experienced capacity for discovery thinking, the mining geologist must add the technique of photogeology. The exploration man does not "map geology" (whatever this means) but he searches for ore targets. Neither can the mining geologist engage a photogrammetrist to do his mapping for him no more than the field geologist can engage a surveyor to do his geologic mapping.

The proper application of mining photogeology brings the continuous surface plan-view into full focus and use. This information, in some localities, can be almost as valuable as the full composite of all underground information on a given property. On a



This photogeologic map shows fractures mapped by the weight-of-line method, which is rather standard practice in mining exploration when mapping underground workings. Fracture lines graphically display distribution, attitude, pattern, prominence (degree of openness), and strike continuity of fracture-plane outcrops. The map was made in an attempt to determine relationships between uranium ore bodies (in red) and intersections of certain types of fractures in Sections 19 and 20 of T13N, R9W of the Grants district, New Mexico.

property or over the area of a district or region, photogeology not only greatly increases the efficiency of gathering surface information, but it greatly multiplies the amount of information available through increased power of observation.

Mining photogeology must be done by mining geologists; they cannot depend on base-map photogeologists, oil photogeologists, or photogrammetrists to do their mining photogeology for them for reasons that are intrinsically self-evident.

Background

The stress of this background discussion will be the geologist—the man—rather than the subjects of geology and exploration. His accumulated knowledge, his ability to apply it and his capacity for original thinking—these determine practice. His wisdom forces progress in discovery rate; his limitations retard it.

The only justification for the geologist in exploration, of which the writer is aware, is reduction of risk. Concepts or techniques which will (1) further reduce risk, or which will (2) reduce risk at lower cost, are significant and direct to the exploration problem. Mining photogeology, properly applied, will accomplish both, i.e., reduce risk and cost.

Most mining companies have two separate geological efforts. These are (1) maintenance of reserves at operating mines, and (2) exploration for new mines (general exploration). Although under varying organizational panels and with varying titles, men who conduct these efforts are known respectively as resident geologists or engineers and as exploration geologists or engineers.

Commonly, within the mining organization, a man must serve as a resident before being assigned on general exploration. It is believed that he should crawl around inside some orebodies, do mapping between clusters of them, and discover extensions and nearby new orebodies before undertaking regional search.

The wealth of exploration know-how possessed by the exploration departments of major mining companies is most impressive. This knowledge represents decades of accumulated thought from many individuals. The geologist who attempts mining exploration, having missed his training with a large, long-established exploration organization, has missed a great advantage. Such experience is his "internship."

A geologist is a scientist with knowledge of the earth and methods of studying the earth or parts thereof. A mining geologist is a geologist with the special knowledge of methods of finding new orebodies or extensions of known orebodies. If qualified, he should understand mining

(*Continued on page* 73)

Thomas W. Mitcham has a broad background of geologic experience. He served the Shattuck Denn Mining Corp. as engineer, assayer and assistant chief engineer; Mexican - American Metals Syndicate as exploration engineer, and American Smelting & Refining Co. as resident geologist and exploration geologist. He has also been assistant chief, Geologic Branch, Member Research Committee, U. S. Atomic Energy Commission. Other positions held by Dr. Mitcham includes chief geologist, Strategic Minerals, Inc, and exploration manager, International Ranwick, Ltd.

The sand and gravel industry has grown to be the largest single mining industry in the United States in terms of annual tonnage produced. Along with this steady growth in production, it has gone through an accelerated and varied program of beneficiation in the last decade

Current Developments In Gravel Beneficiation

By W. L. PRICE
Engineering Manager
Keystone Division
Dravo Corporation

Typical jig installation for treatment of gravel

THE history of beneficiation in sand and gravel is typical of most mining industries in that, at one time, it was possible to excavate material, screen it roughly for size and sell it in that condition. However, over the last fifty years, there has been a steady growth in the number and complexity of specifications on gradation, percentage of crushed material, deleterious material, simulated freezing and thawing tests, abrasion tests and many others.

Up until about ten years ago, the field of beneficiation for gravel was a rather limited one. If gravel, as it occurred naturally, could not meet specifications after normal crushing or scrubbing action in an attempt to break up softer deleterious particles, then the deposit was normally considered economically unworkable and abandoned. It is not difficult to see why this was common practice, since gravel is a relatively low priced commodity compared to coal, iron ore or other minerals; and consequently, there is less money available for expensive processing equipment.

Nevertheless, during this past ten-year period, there have been introduced to the industry four different beneficiation processes which had never been seriously considered before. These four processes are heavy media separation, jigging, rising current classification and elastic fractionation.

The first three of these have been developed fully in coal cleaning and then adapted to the treatment of gravel. The fourth process has been developed solely for gravel and depends on gravel's typical rounded shape for its effectiveness.

Heavy Media Separation of Gravel

The first HMS plant for treatment of gravel was erected in 1948. To date there are a total of nine such plants in operation.

Two major independent factors triggered the step into the relatively expensive HMS process. In some areas, the best deposits had been worked out leaving low quality reserves of gravel which could not pass normal specification requirements for

aggregate. In other areas, remaining good deposits had increasing difficulty in meeting tighter specifications for premium aggregates.

In 1948 the Royal Canadian Air Force in Manitoba needed a high grade aggregate for construction of a concrete landing strip. The only gravel deposit anywhere close to this project contained two to ten percent of objectionable shale. The imaginative engineers on this project turned to the experience of other mining fields and a removal of the shale on the basis of different specific gravities was studied. Since the shale had a specific gravity of 2.00 and the gravel averaged 2.60, HMS seemed a natural solution. Pilot plant tests proved this contention and a full scale plant was erected and used for the life of the project.

In 1949, the Dravo Corporation of Pittsburgh, Pennsylvania, was searching diligently for a new method to meet stringent abrasion and soundness specifications from their Ohio River gravel deposit when the thought of a gravity separation splitting the gravel itself came to light. At that time the term specific gravity meant nothing of practical value to the gravel producer. There was no conception of any practical range of specific gravities in his product and any deposit was assumed to be basically of one specific gravity.

With this background, experiments of a preliminary nature were run on various pieces of gravel and a range of specific gravity from about 2.20 to 2.90 was observed with over 50 percent of the deposit between 2.40 to 2.65. Pilot plant HMS runs were made and a definite visual improvement in quality was noted as the specific gravity of the particles increased. Following additional tests and extensive study, a full size plant was built aboard a barge and lashed to a bucket line dredge and placed in full production in 1952. Actual results bore out the pilot plant tests and the plant has been operated steadily since that date, processing over 1,123,000 tons through 1956.

The Dravo HMS plant for gravel stirred up wide interest in the industry and was inspected by numerous producers with specification problems of their own. The next installation of HMS was at Owatonna, Minnesota, where a saleable gravel was produced from a deposit previously considered unworkable. In rapid order other producers found that HMS was an answer to their specific problem. Of the nine HMS plants now in use treating gravel, no two of these have beneficiation problems that are exactly alike.

Test Results on Treated Gravel

A good indication of some of the improvement made in gravel by heavy media treatment is shown in the accompanying Table, a summary of tests run by F. E. Legg, Jr.

From the data shown on Plant No. 1, the absorption (measure of porosity) has decreased $\frac{1.62-.91}{1.62}$ or 44 percent by HMS treatment. The durability factor in freezing and thawing tests on concrete beams has been increased 83/47 or 177 percent.

On Plant No. 3, the absorption has decreased $\frac{1.19-1.00}{1.19}$ or 16 percent and also $\frac{1.40-0.97}{1.40}$ or 31 percent. The durability factor has increased by 87/41 or 212 percent.

Figure 1 shows results of typical tests run in the N.S.G.A. laboratories. "Under the conditions of these tests, heavy media treatment of the gravel at least doubled the life expectancy of the concrete."

Many tests were run by R. D. Walker and J. F. McLaughlin at Purdue University on durability of concrete made with Indiana gravels treated by HMS. The specific conclusions of their study are:

A. "Concrete made with the crushed stone-gravel combinations, where the gravel used had poor field performance, was significantly improved with the heavy media treatments."

B. "Results of Series 1 indicated that further improvement in gravel aggregates was not obtained by heavy media treatment of particle sizes of ¾ inches or smaller."

It can be seen from a study of the above test data that a definite improvement has been made in gravel by HMS treatment.

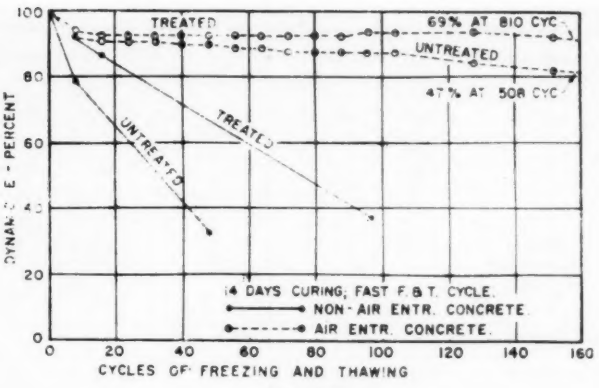


FIGURE 1

Treatment of Gravel by Jigs

Shortly after the heavy media process was established for gravel, an attempt was made to use the standard jigging process. In this sequence, the gravel industry progressed in reverse of the coal and other mining

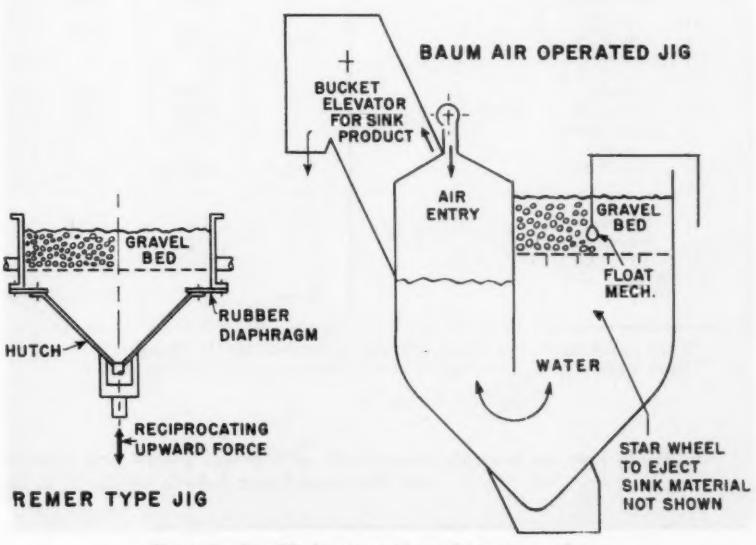
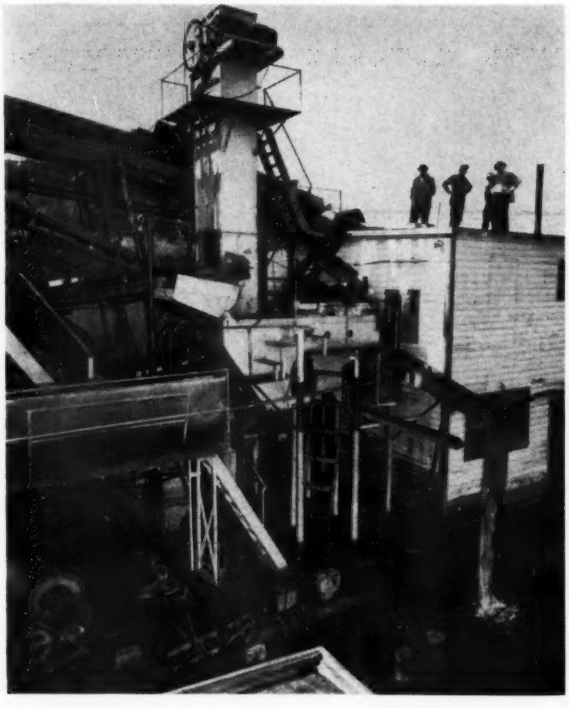


Figure 2. Simplified cross sections of two types of jigs

Coarse Aggregate		Bulk sp. gr. (dry basis)	Absorp. % 24-hour	Batch No.	Strength, psi				Durability Factor	
Source					Compressive*		Flexural**		Beam 1	Beam 2
					7-day	28-day	7-day	28-day		
Plant No. 1	Before Processing	2.62	1.62	1	2205	2915	705	730	88	78
		2.62	1.62	2	2490	3555	755	855	33	53
				3	2860	3765	635	730	7	21
				Avg.	2520	3410	700	770	47	
	Media Processed	2.70	0.91	1	2255	3175	665	765	56	89
		2.70	0.91	2	2435	3230	695	795	96	79
				3	2490	3180	730	815	91	88
				Avg.	2395	3195	695	790	83	
Plant No. 2	Media Processed	2.69	1.06	1	2775	3645	655	890	98	92
				2	3215	3895	815	970	93	77
				3	2975	3740	725	790	92	95
				Avg.	2990	3760	730	885	91	
Plant No. 3	Before Processing	2.64	1.19	1	2430	3420	690	850	38	40
				2	3310	3720	705	835	51	31
				3	2760	4080	660	825	23	63
				Avg.	2835	3740	685	835	41	
	Media Processed	2.68	1.00	1	3330	4415	755	860	87	88
				2	2700	3805	625	845	70	90
				3	2780	3720	715	865	94	90
				Avg.	2935	3980	700	855	87	
	Media Processed +10% chert sp. gr.-2.45	2.63	1.40	1	2890	3835	690	730	14	14
				2	3380	4100	690	840	32	9
				3	3345	4165	665	800	24	4
				Avg.	3205	4035	680	790	16	
	Media Processed +10% chert sp. gr. 2.45-2.50	2.65	1.21	1	3165	3670	750	760	21	34
				2	2955	3835	640	810	22	24
				3	3535	4580	770	830	12	32
				Avg.	3220	4030	720	800	24	
	Media Processed +10% chert sp. gr. 2.50-2.55	2.66	1.13	1	3080	3840	670	825	71	41
				2	2760	3900	715	865	12	35
				3	2785	3460	615	845	24	72
				Avg.	2875	3736	665	810	43	
	Media Processed +10% chert sp. gr. 2.55+	2.68	0.97	1	2805	3915	635	725	28	89
				2	2985	3955	650	870	77	61
				3	2980	3455	675	710	40	86
				Avg.	2925	3775	655	770	64	

*Each value shown is average strength of two 4x8 inch cylinders.
**Each value shown is average of two breaks on one 3x4x16 inch beam.

Durability tests on concrete mixes made with gravel before and after heavy media processing—from Highway Research Board Bulletin 143 by F. E. Legg, Jr.



Belknap gravel washer installed aboard Ohio River dredge

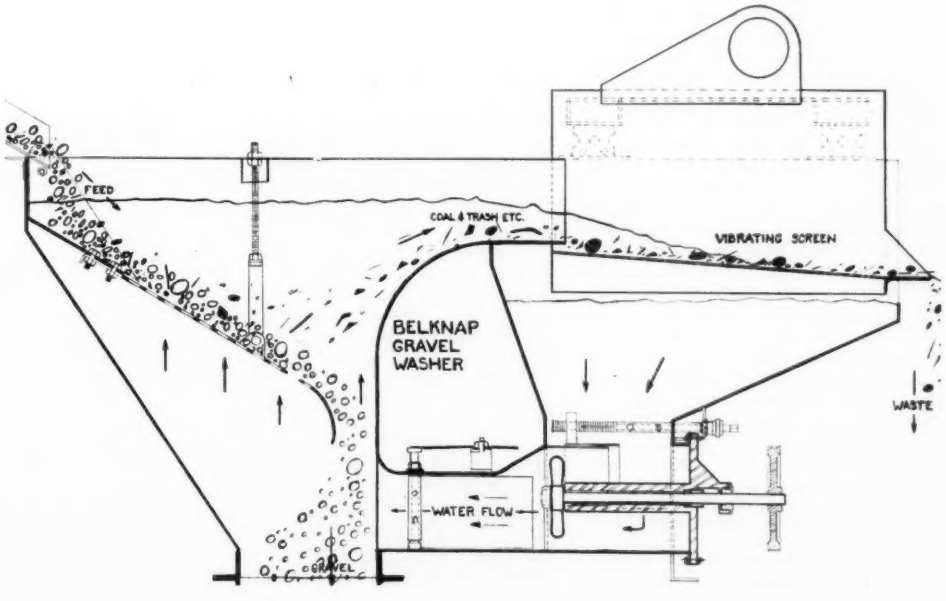
industries who used jigging first and later the HMS process.

In 1954, the McGrath Sand and Gravel Co. of Chillicothe, Illinois, installed the first Remer-type jigs used in the treatment of gravel. Accurate test results are not available on this plant but there was sufficient improvement shown in the product that the J. K. Davison Co. of Pittsburgh felt the process was suitable for their contamination problem. Jigs were installed on their river dredge. Since then there have been 21 jig installations in gravel treatment plants.

In attempting a comparison between the HMS process and jigging of gravel, the picture was reasonably clear-cut as between the relatively simple Remer-type jig and heavy media. However, with the introduction of the Baum air-operated jig, the comparison is not as simple as before. The latter is a more complicated, more expensive piece of equipment and alleviates some of the shortcomings of the simpler Remer-type jig. The Baum jig has an integral submerged dewatering elevator for the sink and hutch product. The level of the jigging bed is controlled closely by a float in the bed which speeds up or slows down a mechanical discharge wheel used to remove the sink product. Figure 2 shows the basic difference between the Baum air-operated and the Remer-type jig.

Since no detailed operating data is available yet on use of the Baum jig, it must be omitted from detailed consideration at this state. However, the writer would like to offer several points of comparison between HMS and the previously mentioned Remer-type jig.

1. The HMS process requires a much higher initial investment than Remer-type jigs. Maintenance and wear on HMS equipment should normally be higher in cost per ton treated.
2. Operating labor cost is about identical. Each normally requiring one man in attendance.
3. The HMS process can stand extreme variations in tonnage of feed from 100 percent to 0 to 100 percent again in a short time with no adverse effect on the separation process. Separation by Remer-type jigging is most efficiently done with a steady tonnage of feed. Rapid changes in feed tonnage cause the loss of the height of bed with consequent disruption of the separation process. With rapid fluctuation in tonnage, the jigs should be attended closely for manual adjustment if the separation is to be reasonably continuous.



Sketch showing the operating principle of a hydraulic rising current classifier

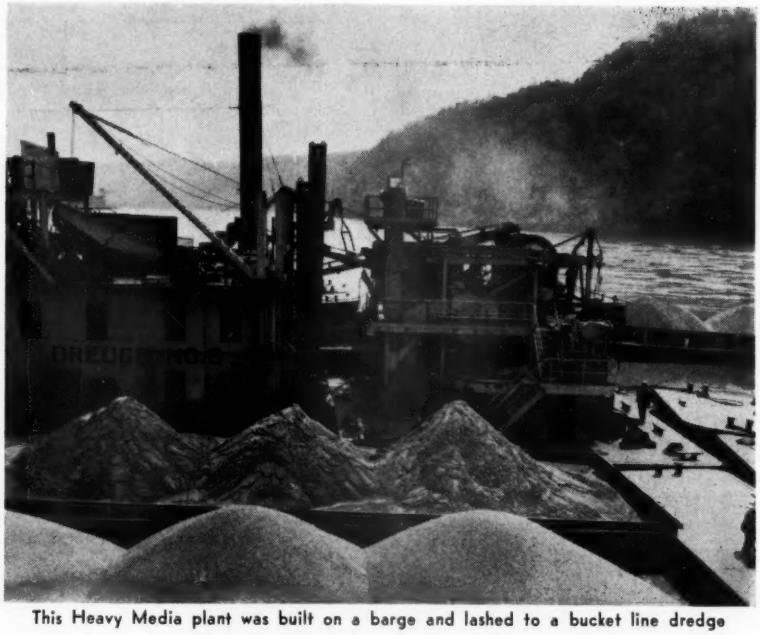
4. The jigging process works most efficiently with a steady supply of water. Rapid surges in pressure or volume require manual adjustment to keep an optimum separation.
5. With rapid fluctuation in the percentage of deleterious material to be removed, the separation by HMS is not adversely affected. With Remer-type jigs, either a steady manual adjustment is required to take care of this fluctuation or the machine must be set to remove the maximum percentage of bad material with consequent inefficiency when the feed percentage varies widely.
6. If a clean "cut" is required at a given specific gravity as in some plants, the HMS could be expected to make a more efficient separation. In many cases, however, this clean "cut" is not required in gravel; and the jig separation is entirely satisfactory.
7. Jigs have a basic advantage in being able to treat smaller size feed. HMS is limited in this respect by the fact that the media must be recovered by screening the product.
8. As to operating costs, the writer would estimate the HMS cost range for gravel to be in the vicinity of 15¢ to 20¢ per ton depending in part on the proportions of magnetic and ferrosilicon. It is estimated that the Remer-type jigs would cost about 5¢ to 10¢ per ton.

Hydraulic Rising Current Classifiers

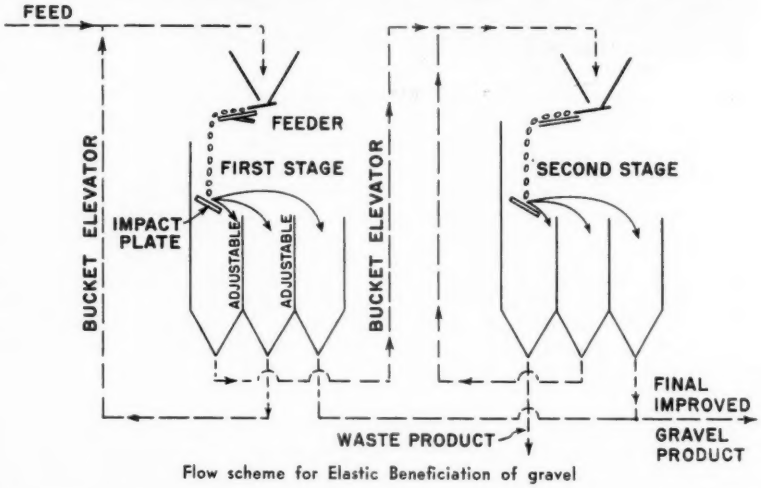
In this process, the gravel industry again turned to coal preparation experience to try the Belknap Gravel Washer. This unit was installed aboard an Ohio River Dredge to remove coal, sticks and trash from the finished gravel product.

The operating principle is a simple one and is clearly shown in accompanying sketch. The machine is 48-in. wide and can treat 100 to 150 tph requiring about 15 hp. To wash the light material out of the gravel, 1500 to 1700 gpm of water is recirculated continuously through the vertical throat to lift the light material over to the screen. The gravel sinks down the throat to a submerged bucket elevator. The 4-ft wide x 3-ft long screen is used merely to recover the water for re-use. About 50 to 100 gpm of make-up water is required to counteract the losses.

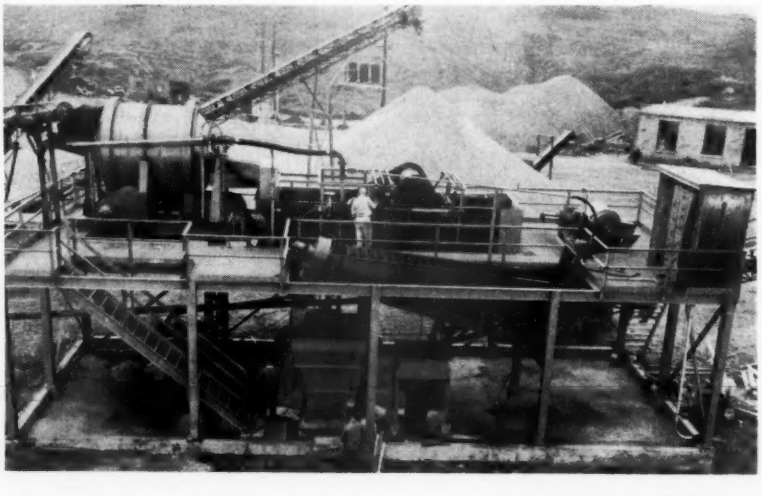
From observation, the unit seems to be doing an excellent job of cleaning gravel. Following initial bugs to be worked out, maintenance on the unit is reported to be low. No test data is available on the process, but additional installations are being planned.



This Heavy Media plant was built on a barge and lashed to a bucket line dredge



Flow scheme for Elastic Beneficiation of gravel



HMS plant for treating gravel from a pit deposit

Elastic Fractionation of Gravel

A rather unusual process for improving the quality of gravel is a new process known as "elastic fractionation." A simplified definition of this term would be the removal of soft and deleterious gravel by "bouncing" the particles.

Probably every gravel producer can tell good gravel from bad by its sound as it drops on a storage pile. In the past, some producers had even tried to break up soft particles by dropping gravel from a height. It remained for Dr. E. H. Leslie of Ann Arbor, Michigan, to apply a scientific method plus many hours of experimenting to ascertain that natural gravel could be consistently separated into good and bad by dropping it and bouncing into different compartments. Only natural (rounded) gravel can be used in the process. Crushing gravel destroys its elastic properties.

The height of fall is adjusted to stress the particles somewhat less than the elastic limit in shear in striking the impact plate.

Even though the gravel has an irregular rounded shape, material from a given deposit will bounce in a consistent pattern. Plotting cumulative percentages of "bounced" gravel weights against the "bouncing" distance gives a characteristic "distribution curve" for each deposit.

To use this distribution curve, an arbitrary distance from the bouncing point is chosen—say 20 in. for Ohio River gravel. It will be seen from the two curves that 24 percent of the hard gravel and 72 percent of the soft stone will drop behind this distance.

By the same curves, it can also be seen that to get 95 percent of the soft gravel to fall behind the 35-in. position, 45 percent of the hard gravel will also be removed from the feed tonnage without recirculation. Thus it can be seen that the law of diminishing returns soon has an effect here.

The pilot plant test results have accurately followed the distribution curve. Thus to determine the improvement desired, the bouncing distances are picked off the curve and the compartment partitions adjusted accordingly.

To process gravel on a production basis, the feed tonnage must be narrowed down to a ribbon, one particle thick, requiring mechanically vibrated feeders. This "waterfall" effect lessens the interference between particles. A plant handling 100 tons per hour requires from 16 to 24 ft of width for the primary stage and 8 to 16 ft of width for the secondary stage depending on the characteristics of the gravel. Two bucket elevators are required, one for each of the two stages.

In practice, the gravel is bounced into one of these compartments. The width of each compartment is instantly adjustable for feed changes. The portion bouncing the furthest into compartment No. 3 is the final improved product to be loaded out. Gravel bouncing into the second compartment is a middling product and must be recirculated back to the initial feed point by means of a bucket elevator. This recirculating load on the first stage can amount to 10 to 60 percent of initial feed.

The gravel bouncing the shortest distance and dropping into the first compartment is the poorest grade or discard from the first stage. It is re-elevated and becomes feed for the second stage shown. The second stage is a smaller duplicate of the first with three similar compartments.

The recirculating load in the second stage can amount to 100 percent of its feed. The second stage will normally handle a total feed load of approximately half of that of the first stage. A 100 ton per hour plant requires approximately 40 hp.

To date one commercial plant has been constructed and placed in operation. No operating data is available at this time; but a very definite visual improvement in quality can be observed by the casual observer and there is no reason to doubt that the commercial plant will follow the full scale pilot plant results.

MINING PHOTOGEOLOGY

(*Continued from page* 67)

economics; otherwise he cannot define "ore," the object of his search. In particular, he masters "target selection;" such specialized knowledge is gained almost entirely through experience.

Applications

The writer is convinced that the proper application of mining photogeology will accomplish exploration goals at minimum cost, minimum risk and maximum efficiency. The technique can be applied to exploration in a number of ways, some of which are suggested here.

Prospect or mine examinations. The great increase in power of observation, with the use of aerial photographs, makes such use highly desirable in examination work. In fact, in our experience it seems that even the most experienced examiner, as likely as not, may miss the key points of a property when photographs are not used. Time lost in obtaining suitable photographs often tempts one to omit their use in examination work, but examination without them is often a waste of time and effort.

Exploration projects. Mining photogeology is well-applied on specific aerial projects. On short projects, covering a given property or a few square miles of ground, specific targets for testing can be efficiently and intelligently selected. Such targets are derived, of course, from critical geologic criteria or ore guides. Longer photogeologic projects can be applied to the detailed search for extensions and new orebodies on an operating property, or to district study.

Exploration programs. Whether the exploration program starts with regional study, with selected districts, or with one district, the best approach should include a stress on mining photogeology.

Selected mining districts should be mapped from aerial photographs, with field checking. Such a study should reveal significant tectonic features, e.g., certain types of fracture intersections which are related to known orebodies. Observed repetitions of such structural situations within districts will suggest specific ore targets for testing. Alteration and sedimentary features can contribute criteria for target selection.

District selection followed by district study, in turn followed by property selection, is a modern approach. The use of the photogeologic technique along with this approach not only makes the approach much cheaper, but it opens up vast new horizons of vision "into the ground." An incidental advantage is that one's activities in a district are more easily kept undercover.

Density of information. The number of specific geologic features recorded per square mile on geologic surface maps varies over a wide range. On the average map, perhaps five features are shown per square mile. Often significant features which can be mapped by ground survey are very limited. On the other hand, where considerable detail is available, mapping by ground survey is costly in time and money. In any case, the use of aerial photographs will (1) increase mapable features—often by 100 fold or more—and (2) reduce costs significantly, if not greatly.

During the past year, the writer has applied the technique of mining photogeology to copper, manganese and uranium properties and districts. Results have been surprisingly encouraging.

The accompanying example of photogeologic mapping represents a map which was prepared in about one week of time. The fractures were mapped in a few days. The writer doubts that any geologist, working by ground survey alone, could map two per cent of the fracture information shown, no matter how much time and money were spent. This example is not an extreme one.

Industrial Engineering

WHAT CAN IT DO?

AMC Committee on Mechanical Loading Assesses the Place of Industrial Engineering in the Coal Mining Industry

By E. B. LEISENRING, JR.
Subcommittee Chairman

THE Subcommittee on Industrial Engineering of the American Mining Congress has, during the past two years, undertaken three projects: (1) a general outline of industrial engineering as applied to bituminous coal mining; (2) a description of the installation of an industrial engineering system into a typical mine of 5000 tons per day, and (3) an evaluation, by questionnaire, of the current use and success of industrial engineering in American bituminous coal mines.

It has been agreed that industrial engineering, as applied to bituminous coal mining, is based on the premise that all cost can be controlled, that the only way to control the total cost is to control each element of expense and that these elements are to be controlled at their point of origin.

The use of the stop-watch to measure the work elements, and the use of standards or budgets, and of graphs based on standards compiled from the stop-watch findings, are the basis of an industrial engineering program.

The steps taken to introduce an industrial engineering program are as follows:

(1) Selection of personnel to inaugurate program
(2) Indoctrination of management above section foreman level in aims and methods of program
(3) (a) Stop-watch collection of work element data
    (b) Training of supervisory force
(4) Achievement of balanced face cycle and determination of smallest crew for optimum tonnage
(5) Establishment of a system of controls
(6) Introduction of production incentives

A balanced work cycle, properly installed, affords work under safer conditions

In describing a modern industrial engineering program for coal mining to those not familiar with it, the most difficult task is to convince the inexperienced mining men of industrial engineering's effectiveness in actual practice. The answer may be "Well, it looks fine on paper, but it wouldn't stand up in actual mining."

Industry Surveyed

In order to give palpable proof of what is being done today, this sub-committee during the past 12 months sent out questionnaires to 33 operating companies or divisions of companies. These groups do not represent all of the bituminous mining companies who are at present employing industrial engineering systems, but they are a cross-section of large producers, most of whom are employing some form of industrial engineering.

Sixteen companies, representing a total of 56,800,000 tons of production in 1956, answered and returned the questionnaires. All of the above tonnage is of deep-mined coal, with strip and auger production excluded.

The description of the steps taken to install an industrial engineering system in a typical 5000 ton per day mine will be illustrated by the answers to the questionnaire, to show what actually is being done in the industry.

Why Install a Program

Most companies said they decided to use industrial engineering when they learned of the results being achieved by other coal companies and companies in other industries. One company answered, "In order to remain competitive, industrial engineering was an operating necessity."

Industrial engineering programs have been highly and successfully developed in other industries, which in almost every case, have had far fewer variables to deal with than has coal mining. Therefore, to use the services of specialists already having the experience of industrial engineers and applying it to coal mining seems the most economical and effective approach to the problem. There is a difference of opinion as to whether mining operators trained in industrial engineering, or industrial engineers trained in coal mining are best suited to handle the assignment. In any event, it is generally agreed that an organization contemplating an initial installation should employ an experienced person or persons from the outside.

In answering a question on this, nine companies said they hired outside consultants, while six companies developed their program from within their own organizations. Most of the outside consultants were industrial engineers, while for the men permanently carrying on programs for the companies, the ratio was 2 to 1 in favor of having mining engineers and production men trained in new methods.

Before proceeding into a program, there is unanimous agreement that top management, from president to general mine foreman, must be sold on the potential of applied industrial engineering. To do this, the management team must be indoctrinated into the mechanics of the system. Top management must be convinced of the competence and sincerity of the persons selected to make the initial installation. Each vice-president or superintendent should then visit successfully operating systems of another company or companies and ask sufficient questions and receive sufficient answers to satisfy him that similar results can be achieved at his operations.

The two primary projects of installing a system are the collection of the work element data by stop-watch and the training of the supervisory force.

Collecting Data

Collection of work element data is accomplished by timing with a stop-watch the separate parts of each man's work as he performs it in the mine, using the equipment with which he works. Example: tram cutting machine, from 20 ft outbye face to face (0.6 minutes), undercut face (5.2 minutes), remove cutterbar from cut (0.3 minutes), etc. Each of these elements must be timed and recorded under varying heights of coal, thicknesses of drawslate, wet or dry bottom, etc., since these of course will produce elements of different time duration. In order to have accurate and applicable data, then, a vast number of elements must be timed and recorded. Right here the inexperienced skeptic jumps in and says, "There are too many variables in coal mining to do all this with any degree of accuracy." The answer to this is that leading companies in our industry *are* doing it on a permanent basis and the degree of accuracy is satisfactory.

The skeptical person may base his doubts on the activities of so-called "efficiency experts" that appeared here and there in the coal mines, particularly during the 1930's. Born of the tough depression years, these stop-watch detectives were generally agents of management used to crack down on the inefficient foreman or miner. The industrial engineer of today may carry a stop-watch, but his aims are different and his methods are now based on the consideration of all variable factors involved.

To implement and streamline the work of the industrial engineer further, one of this country's largest electronic computer manufacturers has recently undertaken a project to cut industrial engineering's data processing time down to a fraction by the use of computers.

Putting New Knowledge to Work

How are all these collected elements then used? From several different methods of performing each work element, one method is proven by the stop-watch to be most efficient (usually the one

done in the least elapsed time). Then these selected best methods are put together and usually their sequence is somewhat rearranged. The final standard face cycle then, under given conditions and changing conditions, is achieved so that the least time is spent in unproductive work, or no work.

This standard cycle for each section is put into operation on each section, taking into account that the cycle will vary as the conditions vary from section to section.

In order to keep the industrial engineering system in effective operation at the face, a most important step is the establishment of a system of controls. Such a system requires periodic checking by stop-watch of the face cycle. If certain work elements do not coincide with the standards established, it is usually an easy matter to diagnose the trouble and put the cycle back on standards.

Fitting hand in glove with an effective industrial engineering system is the effective replacing and buying of mining equipment. Unless the equipment on a section is balanced perfectly, one, or sometimes two, pieces of equipment will be a "bottleneck" to higher production, or the controlling factor, as it is sometimes called. Industrial engineering is usually not needed to tell which piece of equipment is the controlling factor, but without industrial engineering it is impossible to tell how much tonnage increase can be expected and which piece of new equipment is the best choice. Eventual optimum standardizing of equipment can be achieved accurately only through industrial engineering.

Foreman Is the Key

Another way of looking at industrial engineering applied to face work is that previously each section foreman could and usually did, to a certain degree at least, arrange the cycle of equipment moves to achieve, in his opinion, the most production. The fault here is that very rarely, particularly when dealing with tangibles, will human opinion arrive at the optimum result. Wherever we can eliminate chance we are ahead.

This brings us to one of the few obstacles, usually overcome, of an industrial engineering program. That is the task of winning over the section foreman to its use. Actual practice shows that the majority are willing to go along, and in fact, become more enthusiastic, as its benefits are made manifest. A minority of section foremen will balk because they feel that their former yardsticks are being thrown away.

The experience has been that crew members are much more easily sold on industrial engineering than are section foremen. Their pride of job may be strongly appealed to by showing them that, with an optimum work cycle, they can produce more with the same amount of effort or even less effort. A balanced work cycle, properly installed, affords work under safer conditions, which provides additional appeal.

To Start a Program

To time the work elements at the face in a mine of 5000 tons per day, one to three men from the consulting firm will be employed. Accompanying one or two of these men will be a section foreman. The consultant will show the foreman how to time the work elements and allow the foreman to do all or a good part of the timing. Like other mine training, first-hand experience here is worth a great deal more than "paper" work. Section foremen are relieved of their usual duties and are, of course, given their regular pay.

While the work elements are being collected, they are also being analyzed to determine which of a group of variations of an element is the most efficient one. The consultant trains the foreman how to do this analysis, showing him, in the process, that there are several ways of doing each element, and showing him, by proof and not by guesswork, which variation is most efficient. Each foreman does this timing and analysis for three to five weeks. While timing and analysis are being completed, the superintendent and all foremen meet with the consultants for about an hour each week to discuss the methods of industrial engineering and the application of them to their particular mine.

After all work elements are collected and analyzed, the "standards" are set. These are the most efficient methods for any given set of mining condition variables.

Bearing in mind that variations in methods and conditions found at the mine will cause rather wide differences, an industrial engineering program at a 5000 ton per day mine might be installed as follows:

(1) One to three consultants (eight hours per day each) will be used in measuring and analyzing and training supervisors to measure and analyze work elements, in all sections of the mine, for several weeks, depending on how much variation of conditions there is in the mine.

(2) At the same time, one hour weekly meetings should be held by consultants and all mine supervisors, to explain and demonstrate the system and answer questions.

(3) After the collecting and analyzing of work elements by the consultants, two men must be kept on this job full time in order to keep standards up to date with changing mine conditions. The consultant doing this will be replaced by company men trained by consultants as soon as the standards are running smoothly enough.

(4) One or two section foremen are relieved of their regular jobs to accompany consultants and learn the collecting and analyzing of data. Foremen are rotated in this work until all are

familiar with the collection and analysis of work elements.

(5) After the original collection of work element data, work on the sections is gradually rearranged by the trained section foreman, with the help of the consultants, to conform with the new standards. This is the essential step in the effectiveness of the system.

(6) The entire job of collecting and analyzing elements, training the supervisors, and rearranging the work cycles to conform with the new standards should take the consultants about six to twelve months. When the system is working to their satisfaction, they leave the property. No further charges should be due them, except when the company requests a brief return check-up to adjust irregularities. The continuing cost should be two full-time standards supervisors of the company's selection.

One of the questions answered in our questionnaire was, "What percent of reduction in face cost did you expect from the program?" Surprisingly enough, seven companies gave an answer of a specific percentage. The average expected cost reduction was 17 percent.

The next question is no doubt the most interesting of all: "What percent of reduction in face cost do you estimate has resulted?" The individual answers were:

(1) No figures yet—program just being developed.
(2) We have reduced face costs substantially—still have a long way to go.
(3) It is difficult to say the percent of reduction in face cost that has resulted as we have been in a constant state of change in equipment.
(4) Man machine charts are just being instituted.
(5) Actual percentage indeterminate. However, reduction has far exceeded expectations.
(6) At least 20 percent.
(7) Thirty percent.
(8) The face costs have been reduced by over 20 percent. This is actual reduction. No correction was made for increased labor or supply costs. The amount that can be attributed directly to industrial engineering is difficult to say. Probably less than half the reduction so far has been directly influenced by industrial engineering.
(9) Direct results are estimated to be about 15 percent.
(10) Considerable face cost reduction, but no estimate made in percent.
(11) To date exceeded 25 percent.
(12) No estimate has been made.
(13) About what we expected.
(14) No answer.
(15) Varying by mines—20 percent to 30 percent.
(16) Undecided.

Of course, with equipment changes, wage and supply increases and changes in mining conditions, it is next to impossible to give an exact answer to this question. Of those who attempted this, however, the average is about 20 percent. It is significant to note that not one of the 16 companies indicated that the results of industrial engineering were any less than their expectations.

In answer to the next question: "How long has your program been in operation?", each company gave a specific answer. The average was five years.

Incentives

The question of incentives follows a successful installation. Past incentives based on straight tonnage have proven inequitable. Incentives based on varying standards, adjusted periodically to take into account varying conditions, have proven satisfactory in a number of recent cases. In some instances these are paid to supervisors only; in other to both supervisors and miners. Sizeable additional tonnage increases have been reported as the result of incentive plans. In some cases, incentive plans have had to be discontinued or revised downward, with unfortunate results. In any event, incentives is a question to be reckoned with after the industrial engineering program has been put into effect.

The last three questions dealt with the use of production incentives based on industrial engineering. Production incentives seem to be desirable, but are not essential to installing an industrial engineering program. Six companies of the sixteen use no incentives. Of the other ten, six are paying incentives to salaried supervisors, one is paying incentives to supervisors and workers and three intend to install incentives soon.

Of the six companies using incentives, we wanted to know: "How sucessful have they proven to be?" The six who paid incentives to supervisors only answered as follows:

(1) Successful enough so that we do not see how such a program could operate successfully without them.
(2) One hundred percent.
(3) Work measurement and incentives for the foremen increases the productivity level 20 percent above an operation with no work measurement and no incentives.
(4) Very successful in increasing and maintaining production and reducing and controlling costs. It creates a desire to do a better than average job.
(5) Incentive plan started October 1955. In spite of wage increases, results for 1956 indicate slightly lower labor and supply cost than at time plan was instituted.
(6) Incentive plan has not been effective long enough to evaluate.

The company paying incentives to supervisors and workmen alike answered: "Key to the program."

Wheels of GOVERNMENT

As Viewed by HARRY L. MOFFETT of the American Mining Congress

The Administration is hard at work developing new legislative proposals for the second session of the present Congress and attempting to draw up a budget for the next fiscal year which will be substantially lower than that for the current year. Both the legislative proposals, which will run the gamut from a proposed hike in the debt ceiling to mild labor curbs, and the budget will come in for sharp attack on Capitol Hill.

The cleavage between Congress and the White House is growing broader, particularly in the field of foreign policy and defense preparedness. The President expects to take to the stump in various sections of the country to defend his policies and to spell out the status of our defense efforts.

The Senate Labor Rackets Committee has resumed its investigations, and has turned the spotlight on improper activities on the part of some managements in the conduct of labor relations.

The Interior Department now has a new Assistant Secretary for Mineral Resources, filling the post left vacant by the resignation of Felix E. Wormser. Royce Hardy, Jr., of Henderson, Nev., named to the mineral job by President Eisenhower, was formally sworn in on October 15. He is a mining engineer and has served in top supervisory posts at western metal mines.

FOREIGN TRADE ACT BATTLE LOOMS

The Administration has made it plain that Congress will be asked next year to again extend the Trade Agreements Act and to approve U. S. membership in the Organization for Trade Cooperation (OTC)—a controversial move that undoubtedly will precipitate an all-out legislative battle cutting across party lines.

Administration intentions were made known in a "compendium of papers on United States foreign trade policy" recently released by the House Ways and Means Subcommittee on Foreign Trade Policy. Included was a White House statement on foreign economic policy which said, "The executive branch strongly favors continuation of the trade agreement program including the extension of the Trade Agreements Act. . . . The effectiveness of the GATT [General Agreement on Tariffs and Trade] can be greatly increased by establishment of an administrative unit, the Organization for Trade Cooperation. The executive branch will again urge the Congress to authorize membership in the OTC."

A real battle is looked for, with sentiment in Congress for protecting domestic industries from a rising tide of imports gaining strength. In 1955, the Trade Agreements Act was extended for three years by only the narrowest of margins, and thus far foreign trade proponents have been unable to get Congress even to vote on repeated Administration requests to approve U. S. membership in OTC —a project which has received strong Presidential support.

STOCKPILE STUDY UNDER WAY

Defense Mobilizer Gordon Gray has named most of the members of a "Citizens' Advisory Committee" which will conduct a broad appraisal of U. S. stockpiling programs. Anticipated ever since the Administration earlier this year shortened its estimate of the length of a future all-out war from five to three years, the stockpile review will be made by this committee, composed of 12 to 15 citizens not connected with industries which supply commodities to the stockpile. The names of the members thus far appointed have not yet been made public.

Though Gray said he did not have "the slightest idea" what conclusions the committee might reach, it is generally believed the Administration would like to scale down purchases wherever possible, and even to dispose of some of the $6.5 billion worth of metals, minerals and other materials now on hand.

The committee will "make a thorough-going review of stockpiling policies, procedures, criteria and programs," Gray said, and is expected to have preliminary findings ready by January 1. The committee's appraisal will include a material-by-material review.

Gray said the composition of the stockpile will be appraised with respect to these eventualities: A "cold war"—little or no fighting, high tensions and the possible loss of some sources of overseas supply; a "brush fire"—more conventional outbreak of fighting, not nuclear, where overseas supplies may be disrupted; and full-scale nuclear attack. In connection with the latter possibility, the committee may consider the desirability of having stocks of vitally needed finished goods rather than raw materials.

While the group will not spell out just how long various materials should continue to be stockpiled and in what quantity, Gray said the group would set "guidelines" to enable the ODM to decide on specific details.

If the study should result in a Government decision to dispose of any stockpiled minerals or materials, its actions will be governed by stringent safeguards which Congress placed in the laws establishing the national and supplemental stockpiles.

LEAD-ZINC INDUSTRY ASKS TARIFF RELIEF

The Emergency Lead-Zinc Committee has filed with the Tariff Commission a formal application for relief under "escape clause" provisions of the Trade Agreements Act. The Com-

★ ★ ★ ★ ★ ★ ★ Washington Highlights

ADMINISTRATION PROGRAM: Faces tough going next session.

FOREIGN TRADE POLICY: Battle lines drawn.

STOCKPILE: New goals in offing.

LEAD-ZINC: Tariff hearings set.

OIL IMPORTS: ODM requests reports.

MINING RADIO SERVICE: Urged by industry.

ILO MEETING: Government names mining delegates.

TUNGSTEN: Tariff investigation initiated.

URANIUM CONCENTRATES: New AEC policy.

DMEA PROGRAM: Government aid reduced.

★ ★ ★ ★ ★ ★ ★

mittee petitioned for the maximum duties permissible under the law, but stated that "the price of imports is so much lower than the level that is necessary for a healthy and continuously productive mining industry in the United States that . . . the Committee will later propose a system of import quotas."

If the Commission and the President grant maximum increases, the lead import tariff will become 2.55 cents a pound (now 1 1/16 cents), the zinc tariff will rise to 2.1 cents a pound (now 0.7 cents), and the tariff on both lead and zinc concentrates will be 1.8 cents a pound of contained metal (now 3/4 cents in the case of lead and 9/10 cents in the case of zinc).

After pointing out that the President has recognized "that a continuously productive lead and zinc mining industry is of fundamental importance to the national security," the petition said: "The American miners acknowledge that the consumptive demands for lead and zinc in the United States are in excess of domestic production and that continuation of substantial imports is necessary and desirable. They have no wish to penalize American consumers, to deny American industry access to adequate supplies, or to unreasonably raise prices so as to discourage consumption."

The Tariff Commission has scheduled public hearings on this petition beginning November 19, and a strong case is being prepared by the Emergency Lead-Zinc Committee.

OIL IMPORTS REPORTS REQUESTED

ODM Director Gordon Gray is send- to residual oil importing firms reporting forms to be filed with ODM on a monthly basis. The forms will require the setting forth of information as to residual oil imports in the preceding month, the current month and estimated imports for the following six months.

Gray indicated that the forms will enable ODM to keep posted as to progress of the voluntary oil import curbs imposed by the Government, and enable it to have sound information for any future Federal action. He pointed out that these first reports were being distributed by ODM, but that arrangements would probably be made to have all future reports handled by the Interior Department through the office of Captain Carson, administrator of the voluntary crude oil imports program.

Gray's action came on the heels of an earlier Government warning that oil importers must live up to the restrictions of the voluntary program or face stringent Federal action.

MINING RADIO SERVICE SOUGHT

The Federal Communications Commission has decided to revamp its regulations governing assignment of frequencies to industrial and other users of radio communications, proposing abolishment of the Special Industrial Radio Service and creation of a "Business Radio Service." If the proposed regulations become effective, they would have severely detrimental effects upon the mining industry's use of radio.

On October 3, the American Mining Congress filed detailed comments and recommendations with the FCC, as part of its two-year-old effort to obtain adequate allocation of radio frequencies for the mining industry, including the coal, metal mining and industrial minerals branches.

In opposing the FCC proposal, which would classify the mining industry with a wide variety of general business eligible to use radio frequencies allocated to the proposed Business Radio Service, the Mining Congress urged instead allocation of frequencies for exclusive and shared use by the mining industry, on the basis that such frequencies can be efficiently utilized in the public interest.

The Mining Congress and the American Iron Ore Association joined in requesting the FCC to allocate to the proposed mining radio service a total of 31 frequencies on an exclusive basis, and 77 frequencies on a shared basis with the Special Industrial, Utilities, Petroleum, and Forest Products Radio Services.

The FCC may not reach a decision for some time, and there is a good possibility that the agency may propose another set of rules governing use of industrial radio before it completes its action in this matter.

INTERNATIONAL LABOR MEETING SET

The Committee on Mines Other Than Coal Mines of the International Labor Organization will hold a meeting November 25 - December 7 in Geneva, Switzerland. The agenda will include a general examination of the social problems arising in mines, accident prevention in mines, machinery for wage-fixing and protection in mines and industrial relations in mines.

American delegates representing employers at this session will be Denison Kitchel, Phoenix, Ariz., attorney, and Kenneth C. Kellar, Lead, S. D., who is counsel for Homestake Mining Co. They were appointed by Secretary of Labor Mitchell after the American Mining Congress' Board of Directors agreed to nominate delegates, with the understanding that this act did not constitute an endorsement of ILO.

Twenty-four nations are represented on the Committee, and each nation has been authorized to send six delegates to the Geneva session—two representing Government, two representing employers, and two representing workers.

TUNGSTEN TARIFF INVESTIGATION

The U. S. Tariff Commission, complying with the terms of a Senate resolution approved late in the last session of Congress, is gathering preliminary information concerning the differential in the cost of production of domestically produced and foreign produced tungsten ore. The Senate resolution calls for the Commission to submit its findings by March 1, 1958.

No date has as yet been set for public hearings by the Tariff Commission. It is expected that they will be held late this year or shortly after Congress convenes next January. Commission officials have stated that 30 days' notice will be given as to the start of the hearings.

NEW AEC URANIUM CONCENTRATE POLICY

Speaking before the Atomic Industrial Forum recently, AEC raw materials director Jesse C. Johnson announced that the United States had arrived at the point "where it is no longer in the interest of the Government to expand production of uranium concentrate." He said it would be undesirable, both from the standpoint of the Government and of industry, to expand the uranium production rate beyond currently projected requirements and then be faced with a major curtailment at some later date. He indicated that domestic concentrate production is at the rate of 10,000 tons of U_3O_8 a year and by early 1959 will reach 15,000 tons or more.

Johnson said that the AEC will limit commitments for additional domestic uranium production to keep them in line with currently projected requirements. He made it clear that proposals for domestic contracts which have already been submitted to AEC will be given serious consideration. As to new proposals, submitted between now and 1962, for additional mill construction or expansion, he said "the objective of the Commission will be to limit production to the approximate level which will be reached as a result of existing commitments." If new contracts are considered by AEC, preference will be given to providing a limited market for areas having no present milling facilities.

Johnson did make a strong plea for continuation of the uranium exploration program. He said this must be continued on a broad scale if the nation is to achieve the atomic power development anticipated in the next ten to twenty years.

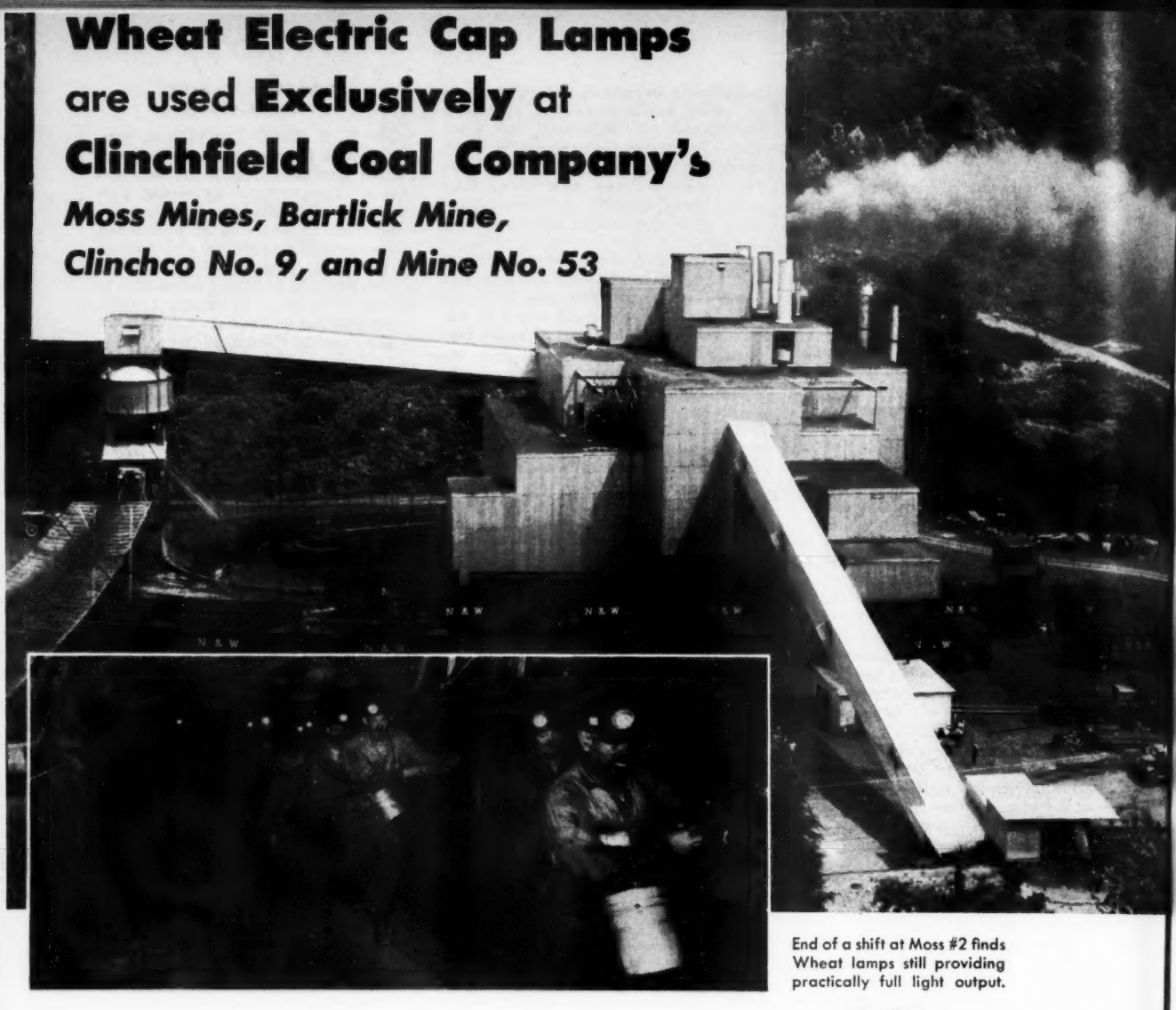
DMEA REVAMPS LOAN PROGRAM

Federal financial participation in the search for several minerals under the Defense Minerals Exploration Administration program has been reduced from 75 percent to 50 percent. The Government will now contribute

(Continued on page 86)

Wheat Electric Cap Lamps are used Exclusively at Clinchfield Coal Company's

Moss Mines, Bartlick Mine, Clinchco No. 9, and Mine No. 53



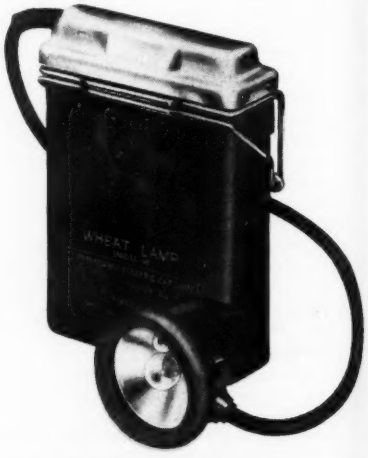
End of a shift at Moss #2 finds Wheat lamps still providing practically full light output.

More and more mining companies like Clinchfield are recognizing and enjoying the advantages of full-shift performance and exceptionally low-cost maintenance obtained with Wheat Automatic Lighting.

The Wheat "Forty-Niner" offers the mining industry a high standard, uniform, continuous light which requires no maintenance beyond ordinary cleanliness, weekly watering, and occasional bulb replacement.

With Wheat Automatic Charging no manual attention is involved. Miners rack their own lamps in less time than it takes to turn them in to an attendant. Each lamp goes on charge as it is racked—automatically. Each lamp takes only the current needed to complete its charge—automatically. And each lamp can be left for days without danger of overcharge or harm—always ready for instant use.

For full details on Wheat Automatic Lighting, consult your National Mine representative or write.



The Trend is to Wheat

National Mine Service Company

National Mine Service Company

564 Alcoa Building • Pittsburgh 19, Pennsylvania

All-State Division, Logan, W. Va. · Anthracite Division, Forty Fort, Pa. · Ashland Division, Ashland, Ky. · Bemeco Division, Beckley, W. Va. · Clarkson Division, Nashville, Ill.

Kentucky-Virginia Division · Western Kentucky Division · Whiteman Division · Mountaineer Division

AMC Personals

Merl C. Kelce, president of Peabody Coal Co., was recently elected a member of the Board of Directors of the

American Mining Congress, succeeding his brother, L. R. (Russell) Kelce, who served as a director of the Congress from 1949 until his death in July of this year.

Charles E. Schwab has been appointed to the newly created position of assistant to the president of the Bunker Hill Co., according to John D. Bradley, president. Schwab, who has been manager of employe and public relations at the company's Kellogg, Idaho, operation, was transferred to the company's main offices to assist the president in all phases of Bunker Hill's growing operations. He is also chairman of the Emergency Lead, Zinc Committee which is seeking industry relief through the Tariff Commission. **B. F. Mahoney** has been promoted from assistant manager of the employe and public relations division to take Schwab's place.

C. E. Schwab

Bradley also announced the appointment of **Stanley W. McDougall** to the newly created post of manager of Kellogg Operations. McDougall, formerly manager of mines, will oversee operations of Kellogg plants and all Kellog division managers will report to him. Bradley said that McDougall's appointment would relieve **Wallace G. Woolf**, vice-president in charge of Kellogg Operations, of many operating details to devote more time to policy-making phases of his position.

Alfred J. Dickinson has joined Freeport Sulphur Co. as vice-president and sales manager, succeeding the late Roy B. Johns, according to an announcement by Thomas R. Vaughn, vice-president. Dickinson was formerly vice-president of Virginia-Carolina Chemical Corp.

Royce A. Hardy, Jr., of Henderson, Nev., took the oath of office as Assistant Secretary of the Interior for Mineral Resources, October 1[illegible]. Nominated by President Eisenhower on

September 22, he succeeds Felix E. Wormser who resigned June 15, 1957.

Hardy has been general manager of Manganese Inc., Henderson, Nev., since February 1956. Prior to that time he was general superintendent of the Getchell mine, Humboldt County, Nev.

As Assistant Secretary for Mineral Resources, Hardy will supervise the programs of the Bureau of Mines, the Geological Survey, Office of Oil and Gas, the Defense Minerals Exploration Administration, the Office of Minerals Mobilization, and the Division of Geography.

R. D. Bradford has been named head of the Federated Metals Division of American Smelting & Refining Co. He will retain the presidency of Lake Asbestos of Quebec Ltd., Asarco's new asbestos producing facility. Bradford has been associated with American Smelting & Refining Co. for 31 years. He was named a vice-president in 1952 and elected a director in April of this year. He has also served as president of the Utah Mining Association and was a force in the postwar expansion of Garfield Chemical & Manufacturing Co., a joint affiliate of Asarco and Kennecott Copper Corp.

Three management promotions in U. S. Steel's Coal Division were announced by Woods G. Talman, general superintendent. **Joseph W. Lavender, Jr.**, maintenance foreman at No. 14 mine, was promoted to general maintenance foreman. He joined the corporation in January 1947 as an outside laborer and steadily advanced to maintenance foreman. **William D. Hooker** was appointed maintenance foreman at No. 14 mine. Employed by the corporation in 1940, he worked up to assistant mine electrician and maintenance foreman at No. 10 mine, the position he held until his recent appointment. **Arville G. Snow**, maintenance foreman at No. 2 mine, was appointed maintenance foreman at No. 10 mine. Joining the corporation in May 1950 as machinery repairman at No. 2 mine, he has served as shop foreman and maintenance foreman.

Samuel A. Scott, formerly project engineer for the Colorado School of Mines Research Foundation, Golden, Colo., has joined International Minerals & Chemical Corp., Chicago, Ill., as a mining engineer. He is a graduate of the University of British Columbia.

The election of **James F. Bisset** as vice-president for finance of the Pittsburgh Consolidation Coal Co. was announced recently. Formerly vice-president and treasurer, Bisset succeeds **George W. Kratz**, who has retired. **Holly W. Sphar**, who was vice-president and secretary of the Pocohantas Fuel Co., a Pitt. Consol. subsidiary, succeeds Bisset as vice-president and treasurer of the parent company.

I. W. Wilson was elected as the chairman of the board of Aluminum Company of America at a recent meeting of the company's board of directors. He succeeds Arthur Vining Davis who retired August 2.

At the same time the board elected **Frank L. Magee** to succeed Wilson as president of Alcoa. Both men have devoted their entire business careers to the growth and development of Alcoa and the aluminum industry. Wilson had been company president since 1951 and Magee has been an executive vice-president since 1955. Both had been directors for about 20 and 5 years, respectively.

The board also elected **Harold C. Erskine** a vice-president and named three new directors. They are **M. M. Anderson**, Alcoa vice-president in charge of personnel and industrial relations; **Ralph V. Davies**, vice-president and general sales manager, and **George W. Wycoff**, vice-president of T. Mellon & Sons, Pittsburgh, Pa.

J. Paul Kirk has been elected to the board of directors of National Lead Co. He is president and a director of Morris P. Kirk & Son, Inc., a National Lead subsidiary with operations on the West Coast producing lead and zinc alloys, fabricated lead goods and lead exides. He is also president and a director of another company subsidiary, Pioneer Aluminum, Inc. of Los Angeles, manufacturers of aluminum tooling plate for the aircraft and other industries and a distributor of aluminum bar, rod, sheet and aircraft extrusions.

Kirk succeeds H. T. Warshow, who has retired after 36 years of service with the company.

Paul D. Bybee, Jr., has been named general superintendent of Freeport Sulphur Company's Grande Ecaille sulphur mine, near Pt. Sulphur, La. A chemical engineering graduate of Rice Institute, Bybee was employed by oil and chemical firms in Texas until his transfer to Louisiana by Freeport Sulphur in 1953.

— *Obituaries* —

Harold J. Rahilly, 68, former manager of mines, the Anaconda Co., Butte, Mont., died of a heart attack at his home in Whittier, Calif., July 25.

A graduate of the School of Mines, University of Minnesota in 1911, Mr. Rahilly began his mining career in northern Minnesota. Later he worked in Mexico, Alaska and Arizona, and then joined the U. S. Bureau of Mines. With the Bureau he became proficient in underground mine fire fighting techniques and practice, and in 1917 he entered the employ of the Anaconda Co. to organize and direct a program for the control and elimination of underground fires in Butte. Successful in this undertaking, he was often called in as consultant by other mining companies troubled by mine fires.

In 1927, Mr. Rahilly was made superintendent of mines in charge of the Leonard, Tramway, Belmont, East Colusa and West Colusa mines. Several years later he became general superintendent of mines in Butte, and in 1947 manager of mines. After retiring as manager in 1951, Mr. Rahilly made his home in Whittier, Calif., and as a consultant continued the practice of his profession.

Jeremiah D. Murphy, 69, who had friends in the mining industry throughout the world, died September 19.

A native of Butte, Mont., Mr. Murphy began his career with the Anaconda Co. as an office boy 52 years ago. In 1909 he became assistant in the Land and Tax Department, and in 1914 secretary in the Executive Office. He was appointed assistant secretary in 1940.

Other positions held by Mr. Murphy include: assistant secretary of International Smelting & Refining Co. and Butte, Anaconda & Pacific Rwy. Co.; assistant secretary and assistant treasurer of Montana Hardware Co., Interstate Lumber Co. and Patten Mining Co.; secretary and treasurer of Smoke House Copper Mining Co.; and director of Interstate Lumber Co., Smoke House Copper Mining Co., West Mayflower Mining Co., and Mayflower Mining Co.

Edward B. Greene, former Mining Congress director, Cleveland-Cliffs Iron Co. executive, banker and civic leader, died in Cleveland on October 20. A graduate of Yale University in 1900, Mr. Greene was successor trustee of the Yale Corp. from 1925 to 1947.

Starting out in the banking business with The Cleveland Trust Co., Mr. Greene was serving as chairman of the executive officers committee of that bank when he became president of Cleveland-Cliffs in 1933. He was a member of the Advisory Loan Committee, Fourth Federal Reserve District of the Reconstruction Finance Corp., and a member appointed in 1932 by the Ohio Governor, of the Emergency State Banking Committee which prepared a recodification of the state banking laws.

Mr. Greene served as a director of Jones & Laughlin Steel Corp., Eaton Manufacturing Co., Goodyear Tire and Rubber Co., Medusa Portland Cement Co., New York Central Railroad Co., and Harshaw Chemical Co. He was a past president of the Cleveland Chamber of Commerce and an active supporter of a number of philanthropic organizations.

In 1947 when the Cliffs Corp. was consolidated with the Cleveland-Cliffs Iron Co., Mr. Green became chairman of the board and chief executive officer of the enlarged Cleveland-Cliffs company. He became honorary chairman in 1954.

John W. (Jack) Thompson, 82, pioneer milling expert and developer of modern ore milling processes, died September 22.

He was in milling and mining work from the time he graduated from the University of Nevada school of mines in 1898 until the time of his death. Though semi-retired, he was in demand as a consulting milling engineer.

Early experience included working for the Silver King Mining Co. in Utah and the Checkmate gold-silver mine at Pearl, Idaho. He also participated in building a mill at the Kearns-Keith property, Park City, Utah.

In 1913, Mr. Thompson joined F. E. Marcy of Mine & Smelter Supply Co. in development of an experimental ball mill at the Arthur Plant of Utah Copper Corp. (now Kennecott Copper Corp.) that was later placed in operation at several mills.

He followed closely the development and application of flotation methods in milling and this intimate contact with the rapidly changing metallurgical trend created contacts with most principal mining firms of Canada, Mexico, Europe and the United States.

In 1932 he and Lionel E. Booth formed the Booth-Thompson Co. partnership which gave engineering service, operated an ore-testing laboratory, developed and marketed the Agitair flotation machine and built several mills.

The firm was consolidated with the Galigher Co. as its metallurgical division in 1936. Mr. Thompson remained with the Galigher firm as vice-president in charge of field operations.

George W. Reed, 79, died September 9. He retired in 1949 as vice-president of the Peabody Coal Co. In World War I he was a federal coal administrator.

Lynn Harrison Thompson, 69, well-known Utah business and mining executive, died August 25. President of the Thompson & Murdock Investment Co. at the time of his death, Thompson had held the presidency or other high offices in the former Ezra Thompson Investment Co. founded by his father, the Forced Underfiring Co., Kennebec Consolidated Mining Co. and Cardiff Mining & Milling Co.

George S. Ward, 67, secretary of the Harlan County Coal Operators Association at Harlan, Ky., for 26 years, died September 21. So well known in the coal industry that he was called "Mr. Coal" in southeastern Kentucky, Mr. Ward was active in the affairs of National Coal Association, Southern Coal Producers' Association, and at his death was secretary-treasurer of the Kentucky Coal Association which he had helped organize.

New Towboat Enters Ohio River Coal Trade

A sixth diesel towboat has officially entered the Ohio River coal trade for the Island Creek Fuel & Transportation Co., Huntington, W. Va. The twin-screw 148-ft vessel built by Dravo Corp., Pittsburgh, was christened the "I. F. Freiberger" in honor of the chairman of the board of Island Creek.

The new vessel is a sistership to the "Raymond E. Salvati," which Dravo delivered to Island Creek last summer. Like the "Salvati", the new towboat is powered by two Enterprise engines with a combined 2560 shaft hp.

The "Freiberger" can tow 20 bargeloads of coal upstream against the Ohio River current. Her twin four-bladed propellers are stainless steel and rotate inside Dravo Kort nozzles, which increase thrust by directing the flow of water to and away from the propellers. The six rudders, one behind and two ahead of each propeller, are hydraulically operated from the pilothouse.

Of all-welded steel construction, the boat includes such modern features as radar, ship-to-shore telephone, reverse reduction gears and metal-paneled interior walls. Nine staterooms house officers and crew.

Mining Firms Merge

A transaction involving the transfer of common stock has resulted in the merger of Marcy Exploration & Mining Co. with Shenandoah-Dives Mining Co. President of the new company, to be known as Marcy-Shenandoah Corp., will be S. Stokes Tomlin, Jr., of Atlanta, Ga.

Marcy Exploration is a three-year-old company devoted primarily to uranium mining and is owned and managed almost entirely by Atlantans. The Shenandoah-Dives Co. has been associated with base metal mining for several years in the Silverton, Colo., area.

Magnesium Plant Planned

Construction of a $7,000,000 magnesium plant at Selma, Ala., is being planned by the Alabama Metallurgical Corp., it was announced recently by company officials.

The new firm expects to process dolomite from the Montevallo, Ala., area to manufacture high purity magnesium and it is expected that the plant will increase production of commercial magnesium in the United States by about 15 percent.

Alabama Metallurgical is owned jointly by Brooks & Perkins, Inc., of Detroit and Dominion Magnesium Ltd., of Toronto, Canada.

Oglebay, Norton & Co. in Merger

The Boards of Directors of Oglebay, Norton & Co. and several associated companies have recommended to stockholders favorable consideration of plans to merge the several concerns into a single operating firm. The new corporation will be known as Oglebay, Norton Co. and will be headquartered in Cleveland.

Companies involved in the merger are Oglebay, Norton; the Montreal Mining Co.; Columbia Transportation Co.; Ferro Enginering Co.; Pringle Barge Line Co.; Saginaw Dock & Terminal Co.; Richwood Sewell Coal Co.; Fairport Machine Shop, Inc.; North Shore Land Co., and Standard Box Co. Directors who will also be officers of the new firm include: R. C. Norton, honorary chairman of the board; Courtney Burton, chairman of the board; H. S. Taylor, president; E. W. Sloan, Jr., executive vice-president, and L. H. Norton, treasurer. W. D. Hamilton will be vice-president-coal mining, and A. K. Greene will be vice-president-coal sales.

Contest Winners Picked

Winners in the National First-Aid and Mine Rescue Contest held in Louisville, Ky., early in October were announced recently. The contest attracted 49 first-aid teams, seven mine rescue teams and two combination rescue and first-aid teams.

In the first-aid contest, seven teams were awarded places. They include: Island Creek Coal Co., Wyoming Mine, Holden, W. Va.; United States Steel Corp., Frick District Robena No. 2 Mine, Uniontown, Pa.; Hanna Coal Co., Georgetown No. 12 Mine at Cadiz, Ohio; Hanna Coal Co., Glen Castle No. 3 Mine also at Cadiz; Imperial Smokeless Coal Co., No. 3 Mine at Leivasy, Quinwood, W. Va.; South Union Coal Co., North West Virginia Coal Mining Institute, Jamison No. 11 Mine at Edna, W. Va., and Inland Steel Co., Price Preparation Plant at Wheelwright, Ky.

The mine rescue awards were won by U. S. Steel Corporation's Coal Division, Lynch District of Lynch, Ky.

Winners of the combination First-Aid and Mine Rescue Contest were the U. S. Steel Corp., Frick District Mine Rescue and First-Aid Team of Uniontown, Pa., and Island Creek Coal Co., Holden Division, Team No. 1, Holden, W. Va.

Borneo Bauxite Developed

Aluminum Ltd., Montreal, and E. Ott, representing the Ott group, the joint shareholders of Sematan Bauxite Ltd., also of Canada, announced recently that preparations are going satisfactorily for the mining of bauxite deposits located in Sarawak on the island of Borneo in the South Pacific.

According to the announcement, shipments of the ore are expected to begin during 1958 with an anticipated yearly production of 175,000 tons. The bauxite will go primarily to Japanese aluminum smelters.

The deposits were discovered by the Geological Survey of the government of Sarawak in 1949. They had not previously been developed, although deposits are believed capable of producing 2,500,000 tons.

Carolina Barium Plant

Construction of a $75,000 barite ore refinery by the P & R Barium Co. near Gaffney, S. C., was recently announced by W. H. Rodenbeck, one of the principal stockholders of the firm.

Heavy machinery for the new plant was shipped from Utah and Colorado and it is expected that 25 to 30 persons will be employed. The plant will make barium sulfate to be used in drilling for oil.

Field Work Contract for Cuban Nickel Project Awarded

Frederick Snare Overseas Corp., has signed a contract to perform all field work in Cuba for Freeport Sulphur Company's $119,000,000 nickel-cobalt project.

The plant and facilities for mining and concentrating the nickel-cobalt ores will be located at Moa Bay on Cuba's northeast coast, and the concentrates will be refined in the United States. The Cuban portion of the total project represents an investment of approximately $75,000,000.

Between 2000 and 3000 Cubans will be employed during the construction period, and more than 1000 will be required for operation of the Cuban facilities. The over-all productive capacity will be 50,000,000 pounds of nickel and 4,400,000 pounds of cobalt annually.

Work at Moa Bay is already under way, and completion is called for by July 1, 1959. The contract, which is with Moa Bay Mining Co., will be carried out under the direction of Manuel Gamba, vice-president of Snare, and the field work will be supervised by A. A. Chamberlain, also a Snare vice-president. Moa Bay Mining Co. is a subsidiary of Cuban American Nickel Co., the Freeport subsidiary which will conduct the U. S. part of the nickel-cobalt undertaking.

Mining Firm Diversifies

Shattuck-Denn Mining Corp., has acquired majority control of Richmond Anchor Screw Co., Inc., one of the oldest and largest manufacturers of concrete form tying and anchoring devices. It has plants in Brooklyn, N. Y., and St. Joseph, Mo.

Shattuck Denn operates the Iron King mine in Humboldt, Ariz., and a uranium mine in Uravan, Colo.

Lehigh Forms Two Sales Units

Announcement was made recently by the Lehigh Coal & Navigation Co. of the formation of two new subsidiary sales companies to strengthen its coal sales organization. The announcement said that the Lehigh Co. had merged with Weston Dodson & Co. to form the Lehigh Navigation-Dodson Co. Earlier this year, Lehigh acquired the Coone County Coal Corp., a West Virginia soft coal producer.

Lehigh Navigation - Dodson will handle only anthracite with Weston Dodson's current bituminous business being turned over to Lehigh-Boone, which will be a sales firm devoted to soft coal sales. Vernon B. Bickmore, currently vice-president of Weston Dodson, was named president of Lehigh-Boone and Truman M. Dodson, now president of Weston Dodson was named vice-president of the new company.

Increased Exports Seen

John S. Routh, president, Coal Exporters Association of the U. S., Inc., said recently that 1957 export shipments of American coal will total between 59,000,000 and 61,000,000 tons. This would be an increase of 15 to 20 percent over the 1956 total of 51,054,171 tons, and does not include shipments to Canada which should amount to between 22 and 23 million tons for the year. Mr. Routh said, after reading the many different estimates of this year's export volume that have recently been published, that his figures represent the opinion of the Coal Exporters Association.

"Since Labor Day," he said, "there has been a considerable resumption in buying in the export market which reflects a stabilization of ocean vessel rates at a very low level. This permits the foreign buyers to fill their coal requirements with U. S. purchases at a lower delivered cost."

WHEELS OF GOVERNMENT

(Continued from page 79)

only 50 percent of the total allowable costs of a project in the case of asbestos (strategic chrysotile), bauxite, cadmium, chromium, columbium, copper, corundum, diamonds (industrial), fluorspar, graphite (crucible flake), kyanite (strategic), lead, mercury, molybdenum, monazite and rare earths, platinum group metals, quartz crystals (piezo-electric), tantalum, thorium, tin, tungsten, uranium, and zinc.

The Government now will contribute 75 percent of project costs in the case of antimony, beryl, cobalt, manganese, mica (strategic), nickel, rutile-brookite, selenium and talc (block steatite).

Kennecott to Expand

Frank R. Milliken, vice-president, Kennecott Copper Corp., recently confirmed an announcement by Anne Arundel County, Md. officials that Kennecott has agreed to purchase from the Baltimore & Ohio Railroad a tract of land of about 200 acres in Anne Arundel County near Baltimore. The land will be used as the site for a new electrolytic copper refinery expected to cost approximately $20,000,000.

Mr. Milliken stated that in recent years customers' requirements have called for less fire refined and more electrolytically refined copper. He pointed out "the new refinery will permit the electrolytic refining of blister copper from the Chilean property of our subsidiary, Braden Copper Company, and the supply of European customers from this source."

"The new site," he added, "is well-suited for building and all necessary facilities and services for the operation are provided. Good transportation by water, rail and highway will be available to handle incoming shipments of blister copper for refining, and outgoing shipments of electrolytic copper for delivery to customers. Room for possible future expansion is ample.

"Plans call for buildings and equipment incorporating the latest techniques in electrolytic refining, copper casting and materials handling. There will be two main buildings as well as an office building, a warehouse, and service installations."

It is expected that the new plant will employ approximately 450 people, most of whom will be recruited locally. Plans call for initial monthly capacity of 7000 tons of electrolytic copper and for operations to commence in 1959.

Society Honors Island Creek

Raymond E. Salvati, president of the Island Creek Coal Co., was the guest of honor and spoke on the history of his company at a National Newcomen Dinner of the Newcomen Society of North America held in New York recently. Newcomen addresses, such as presented by Mr. Salvati, are given by leaders in their respective business fields, and are in most cases a life-story of corporate organizations.

In tracing the history of Island Creek, Salvati singled out for special praise William H. Coolidge, Albert F. Holden, T. B. Davis and J. D. Francis, all of whom served as top officials of the company. Coolidge was chairman of the board until his retirement in 1934. Holden was the first president, Davis the second president and Francis served as president from 1934 to 1949 and board chairman from 1949 to 1952.

Salvati said that at the turn of the century the United States Coal & Oil Co., of Boston, whose name was changed in 1915 to Island Creek Coal Co., bought 30,000 acres on Island Creek in Logan County, W. Va. Its capital stock was $6,000,000 and it had no bonds. It was estimated that the 30,000 acres purchased by the company contained more than 300,000,000 tons of high-quality bituminous coal.

Actual development work was started in 1902 and after 4½ years the property started to show a profit. Salvati said that since that time Island Creek has shown a profit each year and that in 1957 sales will reach over 18,000,000 tons. He also said that during the company's life, including the first half of 1957, Island Creek has recorded net profits in excess of $146,000,000 and paid cash dividends of $103,000,000. He estimated the unmined recoverable coal exceeds 560,000,000 tons.

New Beryllium Plant in Ohio

A new plant for the processing of beryllium is nearing completion near Elmore, Ohio, by the Brush Beryllium Co. of Cleveland and operations are expected to start later this year. The plant is expected to cost approximately $4,500,000 and will be one of the largest and most modern plants of its type in operation. It has a rated capacity of 10,000 lb a month and its production can be expanded by around-the-clock, seven-day operations, according to N. W. Bass, vice-president in charge of sales.

At the plant, beryl ore will go through a series of Brush-developed chemical and metallurgical processes. The billets of raw metal are pulverized and then compressed under heat and temperature into metal blocks for machining into structures and shapes.

Inco Grants Chair

The International Nickel Co. has established a Chair in Chemical Metallurgy at Columbia University, it was announced recently by Dr. Grayson Kirk, president of Columbia. The Chair is endowed by a grant of $350,000, and in addition to the basic grant, the company made a gift of $75,000 for special expenditures incidental to establishment of the Chair.

Henry S. Wingate, president, International Nickel, explained that the company wishes to support fundamental research in the surface chemical and physical aspects of many problems in mineral beneficiation and extraction metallurgy.

"The demands made today for improved practice in the extraction of metals from their ores, particularly necessary in a period of generally rising industrial costs, call for a better understanding of the scientific bases of this technology," said Mr. Wingate. "We hope that this Chair, the work of which will extend beyond any previous studies on the properties of interfaces, will encourage research contributions to basic knowledge in this important field."

Metals Firm Organized

The establishment of an integrated firm to produce titanium, zirconium and other light metals for missiles, jet aircraft and nuclear devices was announced by officials of three companies taking part in the project. Included in the new company are P. R. Mallory & Co., Sharon Steel Corp., and National Distillers & Chemical Corp. The company will be capitalized at $55,000,000.

The integrated firm will be known as Mallory-Sharon Metals Corp. with the three participating partners having equal representation on the board. Under the arrangement, Mallory-Sharon Titanium Corp. (now jointly owned by Mallory and Sharon) will acquire all of the titanium and zirconium production facilities of National Distillers plus the entire ownership of Reactive Metals, Inc., now jointly owned by National and Mallory-Sharon.

Mallory-Sharon is the nation's second largest producer of titanium mill products and is currently capable of melting 1,000,000 lb of titanium a month at its Niles, Ohio, plant. Formed in 1951, the company has been purchasing titanium sponge on the open market.

In 1956 National Distillers was awarded a contract by the AEC to supply 1,000,000 lb of zirconium sponge annually for a period of five years. National has under construction a plant at Ashtabula, Ohio, for the production of titanium and zirconium sponge.

Fire Fighting Tests

Foam-producing substances similar to those used in household and commercial detergents and in bubble-bath formulas soon will be tested by the Bureau of Mines, Department of the Interior, as aids in fighting one of the coal miner's most feared enemies—fire, according to Dr. Irving Hartmann of Pittsburgh, Pa., chief of the Bureau's Branch of Dust Explosions.

The "foam plub" technique involving detergents originated at England's Safety in Mines Research Establishment, Dr. Hartmann said. It promises a means of controlling the severe heat and flames of a coal mine fire so that fire fighters can move in and extinguish it.

The foam is generated by spraying a bubble-making solution on a cotton screen or net stretched across a mine passage. As the solution penetrates the net, large bubbles form and quickly fill the entire cross section of the tunnel. This mass of foam is carried by the mine ventilating current to the fire zone, where the water in the foam vaporizes, reducing the oxygen content of the air and subduing the flames.

Cement Merger Planned

Garner A. Beckett, president, Riverside Cement Co., announced recently that negotiations are under way for a merger of Riverside Cement Co., Hercules Cement Corp., and Peerless Cement Corp., and that the board of directors of the three corporations have approved the merger in principle. While some details are still to be worked out, Beckett indicated that discussions are proceeding satisfactorily and that it is hoped the merger agreement can be submitted to the stockholders of the three corporations in sufficient time to permit completion of the merger in December of this year.

Riverside Cement Co., with its business headquarters in Los Angeles, markets cement principally in southern California, southern Nevada and Arizona. Hercules Cement Corp., with its offices in Philadelphia, sells chiefly in the northeastern portion of the United States, and Peerless Cement Corp., of Detroit, sells principally in Michigan, Indiana and Ohio. The total annual capacity of the merged company will be approximately 18,500,000 bbl, making it one of the five or six largest cement producers in the United States. Under the present plans, the combined company would have a new name, and its initial officers would include Beckett as chairman of the board, W. C. Russell, president of Peerless, as vice-chairman of the board and chairman of the executive committee, and D. S. MacBride, president of Hercules, as president.

Erie Makes First Taconite Shipment

The first vessel to load taconite pellets from Taconite Harbor north of Duluth recently made the trip from the Erie Mining Company's pilot plant to the Bethlehem Steel Corp. at Lackawanna, N. Y. The shipment contained about 10,500 tons of taconite pellets and the loading was accomplished through the use of 25 endless belts which carried the pellets from storage bins to the dock face.

A commercial plant, costing more than $300,000,000 is to be completed around the first of the year. It is expected that the new plant will be capable of providing up to 7,500,000 tons of taconite pellets per year containing about 64 percent iron.

Pickands Mather & Co. is managing the entire project which is owned by Erie Mining, Bethlehem Steel Corp., Youngstown Sheet & Tube Co., Interlake Iron Corp., and Steel Company of Canada, Ltd.

Ohio Coal Field Power Plant Planned

The Cleveland Electric Illuminating Co. announced recently that it plans to build generating capacity in the coal fields of southern Ohio to supply needed power in the Cleveland area.

The company plans a $75,000,000 plant on the Ohio River south of Steubenville, and it is expected the plant will be in operation by 1961. Elmer L. Lindseth, president of the company said, "by building the plant on the Ohio River near plentiful coal supplies, electricity can be made more cheaply and then shipped economically over high-voltage lines."

The company now estimates that transportation accounts for 45 percent of the cost of coal. The new plant will include a 335,000-kw turbogenerator which will send the power the 110 miles to Cleveland.

Africa's Uranium Exports High

Africa ranked as one of the world's major uranium producers in 1956 as 4400 tons were exported by the Union of South Africa, according to figures released recently from Cape Town.

The exports amounted to some $95,000,000 during 1956, and ranked the Union of South Africa with Canada and the United States, the world's top producers. It is believed that Africa's billion tons of uranium-ore reserves are greater than those in all North America.

New Ontario Map

A mineral map of Ontario, has been released by the Ontario Department of Mines. Mines and mineral occurrences are indexed by mining divisions, and other tables show the value of production of individual minerals and of separate mining areas.

Enlarged inset maps show in detail the principal mining camps, the natural gas and oil fields of southwestern Ontario, the location of metallurgical works in the Province, and the various offices of the Department of Mines.

The map, available through the publications office of the department, is being sold for $1.00 per copy.

Wisconsin Iron Ore

Ashland Mining Corp. of Detroit announced recently that substantial iron-ore tonnage has been confirmed in its 880-acre tract in Ashland County, Wis., and that the company is considering building a concentration plant at the site. The company estimates that there are approximately 250,000,000 tons of mineable material to a depth of 400 ft. Since last fall, Ashland has shipped 1850 tons of crude material to the pilot plant of Pickands, Mather & Co. in Hibbing, Minn., where extensive tests have been made.

ANCHORAGE CHARACTERISTICS OF ROOF BOLTS

(Continued from page 64)

pull (as with a hydraulic jack). More specifically, these tests showed that, for loads in excess of the installed load, neither the slope of the head-displacement graph nor the overall anchorage capacity was significantly affected by the installed torque, provided the hole diameter was not oversize. This result, which is interesting because of its implications in regard to installation practice, simplifies routine anchorage testing because it implies that the effect of installed torque on anchorage capacity need not be investigated in detail, although it should be verified as a check on proper hole diameter.

Apart from calling attention to certain details that will insure proper interpretation of anchorage test data, it is not intended to propose here a specific test procedure. Equally valid results can be obtained by using somewhat different procedures and equipment, but it is evident that test data can be quite misleading, unless the installation and testing procedure is clearly specified. With adequate attention to a few details, an anchorage test can be quite simple to perform and easy to interpret from the head-displacement graph, based on the slope and the overall anchorage capacity.

U-Power Plant Charged

The nation's first commercial full-scale atomic power plant was charged with a reactor recently as workmen installed a core made up of uranium fuel elements in the power plant of the Duquesne Light Co. near Shippingport, Pa.

The core, which is about six-ft long and six-ft in diameter, was lowered into a 250-ton stainless steel container at the plant. Water passing through the reactor core will be heated and turned into steam which in turn will be fed to a turbine. The turbine will revolve a generator which will manufacture electric power.

A spokesman for Westinghouse Electric Corp., which built the reactor for the plant, said many tests will have to be made before the plant actually begins to produce power for public use.

The $85,000,000 plant has been under construction for three years and is expected to be in commercial operation late this year. When it is, its power will be the first made exclusively from a nuclear process for commercial use.

Malayan Mine Productive

A Malayan open pit mine, claimed to be the most highly mechanized in Asia, supplies over 25 percent of the iron ore imported by Japan and last year produced 1,935,000 tons of ore, almost all of which was shipped to Japanese firms.

The mine is owned by Eastern Mining & Metals Co., Ltd., and is located at Dungun, Trengganu State, Malaya. The company, in addition to mining the ore, operates an 18-mile railway and uses 30 locomotives and 900 ore cars to haul an average of 10,000 tons of ore a day to the coast where it is loaded in freighters for Japan.

VCA Opens New Plant

The Vanadium Corp. of America recently opened new production facilities near Steubenville, Ohio, for the production of low carbon ferrochromium alloys including Vancoram EXLO, a special extra-low carbon ferrochromium alloy used in making high-quality stainless steels and irons.

Officially called the Vancoram plant, the new facilities comprise one of the world's most modern units for making ferro alloys. The plant is located on a 300-acre site and nine buildings have been erected. The larger buildings have furnaces and casting equipment. Adjoining each production building is a separate products preparation and shipping building. Other buildings house offices, laboratories, metallic reclamation operations, power substation and water treatment and service facilities.

It is estimated that the new plant will employ 300 persons.

Preparation Plant Planned

Eastern Gas & Fuel Associates announced recently plans for the construction of a coal preparation plant at the company's Eccles No. 6 mine near Beckley, W. Va.

Company officals estimated that the new plant will cost several hundred thousand dollars and that work on it would be under way by late this year. It is expected that the project will be completed by mid-1958.

The new coal cleaning plant will be able to handle the mine's annual output of about 250,000 tons on a one-shift-a-day basis.

New Mines Building

Architectural design for a new U. S. Bureau of Mines building at Mount Hope, W. Va., was approved recently by the General Services Administration. The structure will be a combined laboratory and field headquarters building and is estimated to cost $700,000.

The building was approved as a lease-purchase project in 1956 and will provide a center for the operations of the Bureau of Mines in southern West Virginia. Lease - purchase buildings are financed by private capital and purchased by the Government on a long-term contract.

Brazilian Iron Ore Tested

Experiments are being conducted in Brazil on "low-grade" iron ore reserves by the Illinois Institute of Technology to determine the economic potential of the deposits. The ore is located in the State of Minas Geraes, where the highest concentration of Brazilian iron ore is located.

It is reported that the "low-grade" ore in Brazil is equal in quality to much of the high-grade ore in the rest of the world. The economic feasibility of processing and shipping the ore from Minas Geraes to the coast 300 miles away is being considered.

BOOK REVIEWS

YEAR BOOK OF THE AMERICAN BUREAU OF METAL STATISTICS

American Bureau of Metal Statistics, 50 Broadway, New York 4, N. Y. $3.00.

The Thirty-sixth Annual Issue, this Year Book for 1956 is the international survey compiled by the Bureau, which is sponsored by important producers of copper, lead and zinc in the United States, Canada, Mexico, Chile and Peru.

The new issue records, for 1956 and prior years, production and other economic statistics on a world-wide basis, of copper, lead, zinc, aluminum, bauxite, gold, silver, tin, antimony, cadmium, cobalt, magnesium, molybdenum, nickel and platinum and sundry ores and metals. Also included are tables of metal prices, monthly and annual; lists of metallurgical plants and their capacities; general economic statistics of the United States; and U. S. duties on principal ore and metal imports, plus other extensive data.

The price is $3 a copy, postpaid to the United States and Canada; $3 plus 25 cents handling and postage to other countries.

FUNDAMENTALS OF WELDING

American Welding Society, 33 West 39th St., New York 18, N. Y. $9.00.

Publication of the first section of the Fourth Edition of the Welding Handbook has been announced. Illustrated and well indexed, it serves the purpose of a textbook on welding as well as a reference work.

The 560-page section has 11 chapters. It contains the basic material —the fundamentals which are needed by all associated with welding activities. Experts in every field of welding have cooperated.

PRINCIPLES OF STRATIGRAPHY

By Carl O. Dunbar and John Rodgers, John Wiley & Sons, Inc., 440 Fourth Ave., New York 16, N. Y. $10.00.

Concentrating on principles, the authors proceed to illustrate these inductively by providing examples from the stratigraphic record. Considerably more than a simple description is obtained, however, through the synthesis and interpretation of stratigraphic data. Dunbar and Rodgers describe the strata as they occur in local areas, correlate these local sections, and interpret the record—of both rocks and contained fossils—in terms of the earth's past history.

The four major sections of the book are: environments of deposition, basic stratigraphic relations, interpretation of specific lithotopes and synthesis. Of the 123 figures and 21 tables in the 356-page volume, virtually all the drawings were specially prepared for the book. They include many maps and cross sections illustrating sedimentary environments and stratigraphic relations.

X-RAY FLUORESCENT TABLES

Bulk Mailing Service, P. O. Box 456, Mount Vernon, N. Y. $2.00.

An 86-page book with complete X-ray fluorescent spectrometer conversion tables for topaz, lithium fluoride, sodium chloride, ethylene diamine d-tartrate (EDDT), and ammonium dihydrogen phosphate (ADP) analyzing crystals has been published by Philips Electronics, Inc.

Compiled by Maurice C. Powers, Technical Services Division, Shell Oil Co., Houston, Texas, the book contains two sections. Part 1 lists elements by ascending atomic number and relates them to the proper two-theta angles. Part 2 lists ascending two-theta angles and relates them to the proper elements.

Values in the tables were obtained with an IBM 650 digital computer and printed with an IBM 407 on multilith masters. Two theta values include very low and very high angles in anticipation of future instrument improvements.

CEA CHART

Construction Equipment Advertisers, c/o Andrews Agency, Inc., 1037 N. Astor St., Milwaukee 1, Wis. $2.00 per set.

The 1957-58 edition of the CEA Chart is off the press. Supplementing the 17 by 22-in. circulation breakdown chart of previous years (which shows at a glance State-by-State breakdowns, issuing schedules and type of audit for 62 publications) there is a 17 by 22-in. two-color map supplement showing circulation boundaries of regional construction magazines, plus a Canadian supplement to the circulation chart.

Copies of charts and maps may be obtained for $2.00 per set or $12.00 per dozen sets. Two charts, or two map-supplements, priced equal to one "set."

TATLOCK'S FOUR CORNERS AND ROCKY MOUNTAINS DIRECTORY

Tatlock's, 608 Majestic Building, Denver 2, Colo. $5.00.

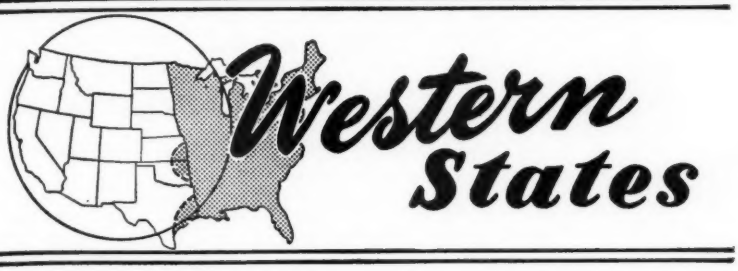
The evidence of growth of the Rockies as an oil and mining province is shown in the more than 9000 listings in this directory. These listings are individuals and companies and do not include cross-indexing of personnel and other features of this publication.

If you know the company or the person, finding the other association is a simple thing due to the cross-index feature, according to the publisher.

Most wanted service is included in the front of the directory. In this portion are listed all Federal and State agencies having to do with oil and mining; personnel and their titles are also given.

State information lists the country seats and abstractors for obtaining leasing data. Directory covers all or parts of the States comprising the Rocky Mountains: Colorado, Arizona, Idaho, Montana, Nebraska, Nevada, New Mexico, North and South Dakota, Utah and Wyoming.

The publication is available in loose leaf form and pocket size.



New Mexico's Sixth Uranium Mill

The U. S. Atomic Energy Commission and Phillips Petroleum Co., of Bartlesville, Okla., have signed a contract for the sale of uranium concentrates (U_3O_8) to the Commission. The contract will result in the construction and operation by Phillips of a new uranium processing mill in McKinley County, N. M., having a capacity of about 1725 tons of uranium ore per day.

Phillips began exploration activities in the Ambrosia Lake Area in 1955 and by early 1956 had blocked out a sufficient ore supply to become interested in proposing a mill operation. At that time the Commission was advised by the company of its interest in submitting a proposal for a milling operation. Preliminary talks were commenced in August 1956, and a formal proposal submitted to the Commission in February 1957.

Construction of the new mill is expected to commence soon with completion scheduled about mid-1958. It is estimated that the plant will cost approximately $9,500,000. This is the fourth contract entered into in recent months involving construction of a mill to treat Ambrosia Lake ores.

The Phillips' mill will be the sixth uranium processing plant to be located in New Mexico to treat ores produced in that state. The site of the new mill is in McKinley County, about 25 miles north of the town of Grants. Ores treated in the plant will include ores from properties owned or controlled by Phillips, as well as a certain amount of amenable ore purchased from independent mine operators of the area.

Idaho Scholarships Awarded

Scholarship awards totaling $6700 to 31 University of Idaho students have been announced by trustees of the Hecla-Bunker Hill scholarship fund. The awards are made annually from a $100,000 fund established by Hecla Mining Co. and the Bunker Hill Co. in 1951.

Scholarships are awarded to sons and daughters of employes of the companies and to student employes, without any stipulations regarding the winners' fields of study. Worthy students who are majoring in mining, geological or metallurgical engineering, as well as related fields, will also be eligible for scholarships, regardless of where they or their parents are employed.

Uranium Mill Construction Deferred

The Atomic Energy Commission has been notified by the Ohio Oil Co. and Arthur E. Pew that they have decided to defer building a mill to extract uranium concentrate from lignite occurring in the western parts of North and South Dakota, pending development of improved ore processing or a greatly increased demand for uranium oxide. They indicated that, as a result of their process studies, their proposed operation was not economically feasible at the ceiling price of $10.50 per lb of uranium oxide contained in acceptable concentrates derived from lignite.

Solomon's Mine Opened

Production of 7000 tons of copper annually has been predicted by officials of the Israel Mining Corp. which recently reopened the King Solomon mines which had been closed for 3000 years. The site of the mine is in a barren wasteland, 15 miles north of Elath on the Red Sea.

Company officials said that both underground and open pit mining would be used and that full production is expected in a few months. The mines, crushers and smelting furnaces of Solomon were left in ruin, but can still be clearly seen at the site where the new mining camp is going up.

Considered as one of a series of projects for developing Israel's Negev Desert, the mine was until recently short of water. This shortage has been overcome by laying a pipeline from an oasis in the vicinity.

Bear Creek Exploration Progresses

Bear Creek Mining Co., exploration subsidiary of Kennecott, has completed cutting station and now is engaged in westward drifting toward a potential ore body in its East Tintic District, Utah, lead-silver-zinc exploration program. Centennial Development Co., which has a contract with Bear Creek for exploratory work, was reported 110 ft out on the drift with about 800 ft to go.

Utah Firms Seek Gold

New Park Mining Co. and East Utah Mining Co. of Salt Lake City are backing the newly organized Yale Gold Mining Co. in a venture in underground gold prospecting in northern Elko County, Nev. Yale Gold Mining has acquired a 20-year lease on the old Elko Prince mine, with option to buy.

The firm also has completed arrangements with Miners Gold Mining Co. of Salt Lake City which would permit access through its property into the Elko Prince workings in the historic Midas District, once a flourishing gold camp. An existing tunnel in the Miners Gold property will be extended 600 ft into the Elko Prince workings. There is water in the old Elko Prince and its main shaft has caved, facts which determined the driving of a tunnel extension as a cheaper means of entry to workings.

Water Shortage Hits Alaska Miners

Alaska placer operators have been hard hit for water this year. The abnormally dry summer held some miners down to a few minutes sluicing a day, and in some of the larger operations it has been difficult to keep dredge pond levels up.

Vitro Signs Uranium Ore Contract

Vitro Uranium Co., Salt Lake City, Division of Vitro Corp. of America, has signed a long-term agreement with Jen, Inc., of Moab, Utah, for the purchase of large quantities of low-lime uranium ore. Under the terms of the agreement, Jen will ship uranium ores from four claims in the Big Indian Mining District of San Juan County to Vitro's Salt Lake City mill.

The agreement extends to March 31, 1962, the expiration date of Atomic Energy Commission purchase contracts. Jen, which has been shipping Vitro substantial quantities of amenable ore for several months, will provide a maximum 10,000 tons of ore per month during the life of the agreement.

Minnesota School of Mines & Metallurgy

By action of the Board of Regents of the University of Minnesota on June 15, 1957, the Minnesota School of Mines and Metallurgy has been reorganized and now comprises the three divisions of Mineral Engineering, Metallurgical Engineering, and the Mines Experiment Station.

Physical Metallurgy has been transferred to the School of Chemistry where it will function as the Department of Metallurgy.

Separate curricula are now available in Metallurgical Engineering, Geological Engineering, Mining Engineering and Geophysics (School of Mines and Metallurgy), and in Metallurgy (School of Chemistry).

Hecla Signs Development Contract

Montana Standard Mining Co., Ltd., has concluded a contract with Hecla Mining Co. for exploration and development of the Montana Standard property in Sanders County, Mont. The contract gives Hecla an option to acquire a 50-percent economic interest in ore found on the Montana Standard property in return for certain exploration and development work. Development work is to be commenced within nine months and shall be continued at the option of Hecla at its sole expense, to be recovered only from the proceeds of ores mines.

The contract also grants Hecla an option to purchase the entire property on or before January 1, 1961.

The property consists of nine patented and one unpatented claim, and is located about 12 miles west of Thompson Falls, Mont. A substantial amount of underground development work has been completed, including a 2400-ft lower adit tunnel and some drift and raise work on the vein.

Moab U-Mill Is Dedicated

Although it has been operating for some time, the $9,000,000 Uranium Reduction Co. mill at Moab, Utah, was formerly dedicated in September before a gathering of more than 1000 persons, with officials from the Nation's capital and the State of Utah on hand to take part in the ceremonies.

The importance of this mill to the domestic uranium industry was pointed out by Jesse C. Johnson, director of the Division of Raw Materials, Atomic Energy Commission, who said:

"For the first half of this year the Uranium Reduction Co. mill was the second largest concentrate producer in the United States and supplied approximately 25 percent of the U. S. production. It was close to first place."

Capitol Has Bunker Hill Exhibit

On behalf of the State of Idaho, Governor Robert E. Smylie has accepted an exhibit depicting The Bunker Hill Company's operations and metal products from John D. Bradley, company president, during informal ceremonies at the State Capitol. In preparation for a year, the exhibit consists of four automatic picture projection machines and a lighted display cabinet filled with lead and zinc products produced by the company at Kellogg, Idaho, and Seattle, Wash.

The picture machines resemble large television sets, and on the push of a button will run off a sequence of 30 colored slides. Activities at the Bunker Hill mine, concentrator, smelter and electrolytic zinc plant are shown. The lighted display case includes samples of standard metal products from the Kellogg smelter and zinc plant and milled products made from these metals at the company's Seattle Fabrication Division.

Bunker Hill is the second largest domestic producer of lead and operates the only smelter in the State of Idaho. Its mine at Kellogg is the largest single lead mine in the country, with 100 miles of shafts and tunnels.

Kennecott Launches Economy Move

Utah Copper Division of Kennecott Copper Corp. is launching an economy program aimed at reducing costs. Stemming from the declining price of copper, the program contemplates no layoffs or reductions in output at this time.

Cost reduction will be accomplished by ending new hirings wherever possible, reducing inventories, and affecting economies in methods of mining, milling, and refining as well as in general operations.

Wyoming Land Withdrawn

The Department of Interior has approved an order withdrawing approximately 3440 acres of public lands within the Targhee National Forest in Wyoming for use of the Forest Service, as a recreation area and public service sites. The withdrawal order closes the lands to all forms of appropriation under the public land laws, including the mining laws, but not to application of the mineral leasing laws.

Seeks Alaska Copper

Kennecott's Exploration Division, Bear Creek Mining Co., continued its exploration this year on the Ruby Creek copper prospect north of the Kobuk River in Alaska. Dahl Creek Mining Co. is building a road to the prospect.

Utah Lead-Zinc Producers Close

New Park Mining Co., one of Utah's principal lead-silver-zinc producers, has closed its properties in the Park City district. The company attributed the shutdown to continuing operating losses which it blamed on dumping of foreign lead and zinc in American markets.

The jobs of some 200 miners are affected; the properties had been producing some 6,000 tons of ore monthly, principally from the Mayflower mine.

Climax Mine Featured on TV

Various phases of mining operations at Climax Molybdenum Company's mountain mine at Climax, Colo., were brought to the living rooms of television viewers throughout the nation on the Wide, Wide World program Sunday, October 13.

Climax supplies the major portion of molybdenum mined in the U. S. and the free world. It has an average daily production of well above 34,000 tons of moly ore.

STATEMENT OF THE OWNERSHIP, MANAGEMENT, CIRCULATION, ETC., REQUIRED BY THE ACT OF CONGRESS OF AUGUST 24, 1912.
Of THE MINING CONGRESS JOURNAL, published monthly at Washington, D. C., for October 1, 1957.
City of Washington,
District of Columbia, ss:

Before me, a notary public in and for the state and county aforesaid, personally appeared Robert W. Van Evera, who having been duly sworn according to law, deposes and says that he is the Editor of THE MINING CONGRESS JOURNAL, and that the following is, to the best of his knowledge and belief, a true statement of the ownership, management, etc., of the aforesaid publication for the date shown in the above caption, required by the Act of August 24, 1912, as amended by the Act of March 3, 1933, embodied in Section 537, Postal Laws and Regulations printed on the reverse side of this form, to wit:

1. That the names and addresses of the publisher, editor and business manager are:
Name of publisher, The American Mining Congress, Washington, D. C.
Editor, Robert W. Van Evera, Washington, D. C.
Managing Editor, George W. Sall, Washington, D. C.
Business Manager, P. D. McMurrer, Washington, D. C.

2. That the owners are: The American Mining Congress—a corporation, not for profit. No stockholders. President, Howard I. Young, St. Louis, Mo.; Executive Vice-President and Secretary, Julian D. Conover, Washington, D. C.

3. That the known bondholders, mortgagees, and other security holders owning or holding 1 per cent or more of total amount of bonds, mortgages, or other securities are: None.

ROBERT W. VAN EVERA,
Editor.

Sworn to and subscribed before me this 1st day of October, 1957.

KATHRYN A. HATHAWAY,
Notary Public.
(My commission expires July 31, 1962.)

Lime Plant Opened

The Chemical Lime Co., Portland, Ore., has opened a $2,000,000 plant near Baker with production from the first kiln commencing October 15.

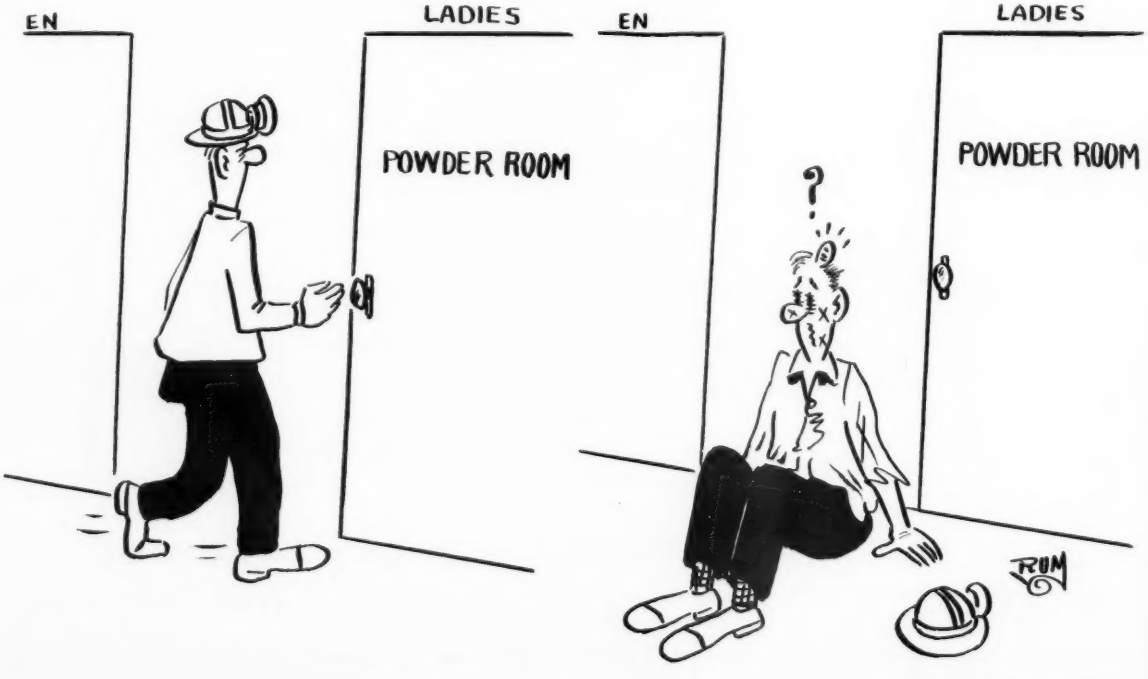
The plant, designed to produce 75,000 tons of chemical lime annually, is the only one of its type in the Northwest.

Mining Companies Merge

Five western oil and mining corporations—Jacob's Chair Mining Corp., Chesapeake & Colorado Corp., Nuclear Magnetic Mining, Inc., Western Oil & Gas Co., and Silver Sage Oil & Mineral Co.—will be merged if stockholders of the companies approve. The surviving corporation will be Jacob's Chair Mining Corp., but concurrently with the merger its name will be changed to Chesapeake & Colorado Corp.

In addition to substantial holdings of Federal Uranium Corp. and Radorock Resources, Inc. stock, the merged company will have oil, uranium, titanium and feldspar leases, claims or properties located in Utah, Colorado, Wyoming, North Carolina and Florida.

Charles R. Rudolph, president of Nuclear Magnetic, will become president of the merged company.



Western Conference Dates Set

The National Western Mining Conference meeting will be held February 6, 7 and 8, 1958, according to Robert S. Palmer, executive vice-president of the Colorado Mining Association. The meeting will be held in Denver again this year as it was last year.

According to Palmer a large section of the program will be devoted to lead and zinc, with other sessions devoted to oil shale, uranium, fluorspar, tungsten, gold, silver, copper, beryllium and other minerals and metals.

William L. Jude, superintendent, New Jersey Zinc Co. operations at Gilman, Colo., will be the program chairman with John W. Hill of the Worcester Mines, Grand Junction, Colo., as vice-chairman.

Freighting Arrangements Completed

Harvey Aluminum has completed arrangements for the freighting of raw materials from the Far East for the company's aluminum reduction plant at The Dalles, Ore. Under the terms of the company's charter with a joint venture of three Canadian firms—North Pacific Shipping Co., Ltd.; Anglo-Canadian Shipping Co., Ltd.; and Western Canada Steamship Co., Ltd.—The Dalles, on the Columbia River 190 miles from the sea, is established on a permanent basis as a regular port of call for ocean-going bulk cargo vessels.

Harvey has chartered approximately 13 cargoes a year for a period of five years. The Canadian carriers will load their cargo of alumina alternately in the ports of Shimizu and Niihama, Japan, and will discharge the cargo at a dock now under construction at the company's plant site.

To facilitate this movement, Harvey has designed and is constructing a large barge-mounted pneumatic unloading system which will suck the alumina from the ship's holds and pump it to shore-mounted storage silos. The unloading equipment can also be used to unload and transfer ores, grain, and other bulk cargoes.

Huge Property Gift

Kennecott Copper Corp. is giving away more than $1,000,000 worth of buildings, land and equipment in Santa Rita and Hurley, N. M., to civic, religious, educational and fraternal organizations in the two towns.

Total value of the gifts has been appraised at $1,147,600. Of this amount, $766,900 represents property in Hurley, while the remaining $380,700 is made up of facilities in Santa Rita. Most of the property consists of buildings valued at $850,150; the rest of the property consists of equipment, land, and public utilities.

The largest single contribution—$509,750—consists of buildings, land and equipment given to the Cobre Consolidated School District. The second largest donation—$316,700—was given to the Town of Hurley.

Other beneficiary organizations include the Community Churches in both towns, the Hurley Catholic Church, the Chino Clubs of Hurley and Santa Rita, the Casino club buildings in both towns, the Hurley Rifle and Pistol Club, the Copper Country Club, the Santa Rita Town Committee and the Santa Rita Masonic Lodge.

New Uranium Mill in New Mexico

Phillips Petroleum Corp. has awarded contract for construction of its new 1725 tpd uranium mill in the Ambrosia Lake district of New Mexico to Western-Knapp Engineering Co., San Francisco. The mill will be located 25 miles north of Grants, where Phillips has developed between 4,000,000 and 5,000,000 tons of proved uranium ore with exploration still continuing. The new mill will utilize a variation of the carbonate leach process.

Manufacturers Forum

Spray or Fire Pump

THIS ROTATING VANE, positive displacement pump employs round stainless steel rollers. This feature, according to Flood City Brass & Electric Co., Johnstown, Pa., eliminates

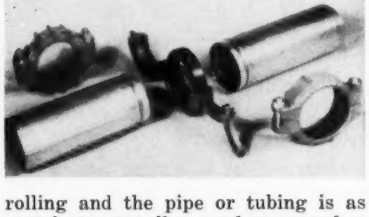
any possibility of dirt or coal particles jamming or damaging the pump. The roller action of the vane is said to reduce friction and lessen power consumption. Built in various capacities, the ten gpm model at 100 to 125 lb pressure is designed for spraying while the 50 gpm model at 50 lb pressure handles fire pump requirements.

— 11 —

Couplings

A METHOD OF QUICK COUPLING thin wall steel and aluminum pipe and tubing has been introduced by the Victaulic Company of America, Elizabeth, N. J.

Named Vic-Easy, the method reportedly provides positive, leak-tight connections through the use of quick couplings assembled on Vic-Easy grooved pipe ends. According to Vic-grooved pipe ends. According to Victaulic, there is no loss of metal in the



rolling and the pipe or tubing is as sound structurally as when manufactured.

The Vic-Easy Method is available for thin wall pipe and tubing in sizes from 1¼ to 12 in., and may be used for working pressures up to 1000 psi, depending on the wall thickness of the tubing and type of coupling used.

Three types of couplings are offered for use in the Vic-Easy Method. One is a Snap-Joint Coupling which is a hinged assembly fastened by leverage and tension. It requires no tools for installation.

A second type is a light-weight coupling for use in low pressure, low external stress application. The third, a heavy duty coupling, is designed for use where high external stress or high internal pressures are expected. These two types can be installed by the use of a single wrench.

Inquiries about new equipment appearing in Manufacturers Forum are welcomed. For additional information on any piece of equipment in this section write directly to the manufacturer, or to Mining Congress Journal with name of item and date of issue in which it appeared.

Solvent

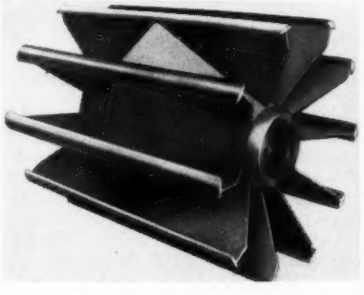
THIS INDUSTRIAL solvent, called Sonic-Solve No. 113, for use with ultra-sonic cleaning equipment is said to offer selective solvency, electrical stability, rapid drying and safety. It reportedly has the power to remove contaminants without affecting plastics, decals, numbers, magnet wire, insulating varnishes, etc. The non-ionic, non-hydroscopic liquid is said to be stable and safe for use with electronic cleaning equipment. After ten seconds in an ultra-sonic cleaner using Sonic-Solve No. 113, completely assembled open relays reportedly are devoid of rosin fluxes, oils, greases and dirt. Another five minutes in an ultra-sonic dryer and the parts are ready for packing. Sonic-Solve also dries rapidly in open air. No rinsing or neutralizing is necessary, it is claimed. It is reported that a wide variety of electrical, electronic, optical and precision mechanical components may be cleaned with this solvent.

For detailed information contact London Chemical Co., Inc., Dept. MJW, 1535 North 31st Ave., Melrose Park, Ill.

Conveyor Pulleys

STEEL SELF-CLEANING conveyor pulleys have been added to the manufacturing lines of Van Gorp Manufacturing Co., Inc., Pella, Iowa.

Sizes range from 8 to 60 in. in



diameter and from 8 to 66 in. in face width, and bore sizes from ½ to 10 in.

These pulleys are said to insure longer belt life because the self cleaning cone design eliminates any material buildup between the belt and pulley and thus prevents belt misalignment. The outer edge of each individual wing is protected by a half oval bar that reportedly reduces belt strain and provides maximum traction.

Combination Air Mask—Resuscitator

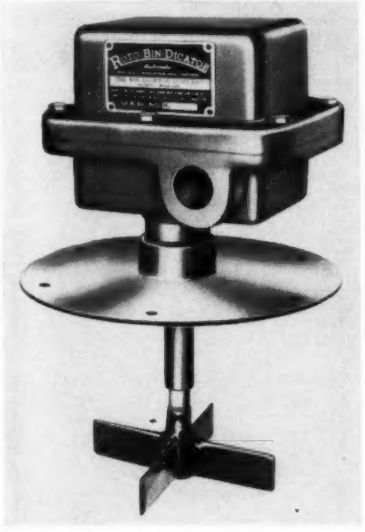
A PORTABLE air/oxygen mask and resuscitator combination unit, providing equal protection to rescuer and asphyxiation victim, has been introduced by the Fyr-Fyter Co., 221 Crane St., Dayton 3, Ohio.

Known as the Dualife and weighing 39 lb, the unit contains 52 cu ft of gas in its two chromaloy cylinders. Resuscitator valve and facepiece are carried in a canvas pouch on the belt strap and attached to the regulator by a quick disconnect, as is the mask valve. Built-in gauges provide the wearer with pressure information, and a warning bell sounds automatically when the compressed air or oxygen supply needs replenishing.

In cases of drowning, electric shock, or other forms of asphyxia not requiring a mask, the unit can be used as a resuscitator alone, and an aspirator can also be used with the unit for removal of mucous or fluid when necessary.

Bulk Material Level Control Device

ENGINEERING CHANGES in the Roto-Bin-Dicator have been announced by the Bin-Dicator Co. According to the firm, improvements were made to permit the use of this equipment



where severe operating conditions may exist, such as vibration and high stresses on the paddle and shaft assembly.

The Roto-Bin-Dicator, which is available in standard and explosion-proof models, is claimed to be particularly adaptable to installations in bins under pressure or vacuum; bins, chutes or conveyors handling materials containing large lumps which tend to "bridge" over a diaphragm; and bins handling materials which tend to "rat-hole" and prevent operation of a diaphragm.

To circumvent these problems, this level control device has a slowly rotating paddle, mounted on a flexible shaft. This projects into the bin and is driven by a small motor mounted in a housing outside the bin. When material in the bin partially or entirely covers the paddle, the rotation of the paddle is stopped and the torque exerted by the motor actuates a Micro-switch in the motor housing. When material drops below the paddle, rotation is resumed and the Micro-switch returns to normal position.

Copies of Bulletin 8-C, giving details of the construction and operating features of the Roto-Bin-Dicator, are available from Bin-Dicator Co., 216-13946 Kercheval Ave., Detroit 15, Mich.

Grease Additive

A SYNTHETIC GELLING AGENT, Oronite GA-10, makes possible the formulation of superior multipurpose and specialized grease lubricants, according to Oronite Chemical Co., 200 Bush St., San Francisco, Calif. It is claimed that grease lubricants made with GA-10 show remarkable heat stability, water resistance, work stability and bearing performance.

Valves

PLUG TYPE globe and angle valves with 500-plus Brinell hardened stainless steel seats and discs have been added to the industrial valve line of the Ohio Brass Co., Mansfield, Ohio.

The valves come in both 150 and 200 lb working steam pressure classes. They are said to be especially designed for use where frequent operation causes excessive wear to ordinary materials or where corrosive service tends to affect the closure surfaces, and are recommended for close throttling of steam, water, oil or air.

These valves are available in eight sizes, from ¼ in. through two in.

Towing Tractors

TWO Paymover towing tractors recently introduced are the model T-50 with 5000-lb drawbar pull and the model T-60 with 6000-lb drawbar pull. The two-wheel-drive units have torque converter drives and automatic transmissions. A wide variety of coupler attachments are said to be available. For detailed specifications write to the Frank G. Hough Co., 846 Seventh Ave., Libertyville, Ill.

Classifier-Concentrator

UTILIZING THE FORCE OF GRAVITY as the separating agency, the T & R Classifier-Concentrator is said to render the following services: concentration, classification, upgrading, desliming and fine mineral recovery.

The process of separation employs vibration, specific gravity, and a reverse riffle or slot which, it is claimed, physically creates a suction pulling the mineral out of the friction deck surface of the tray. The quality of the concentrate is produced by the number of trays in the vertical stack, usually not more than five. The tailing values reportedly can be cut to a minimum by recirculation or by running over additional units.

The tonnage or yardage handled will be determined by the amount of material or mineral that the volume of water will carry over the first tray at any specified angle of fall from three to ten in. per seven-ft tray.

Each stainless steel tray will handle 250 gpm of water. Tray specifications include: weight per tray, 150 lb; height, 2 ft; length, 7 ft 2 in.; width, 16 in.

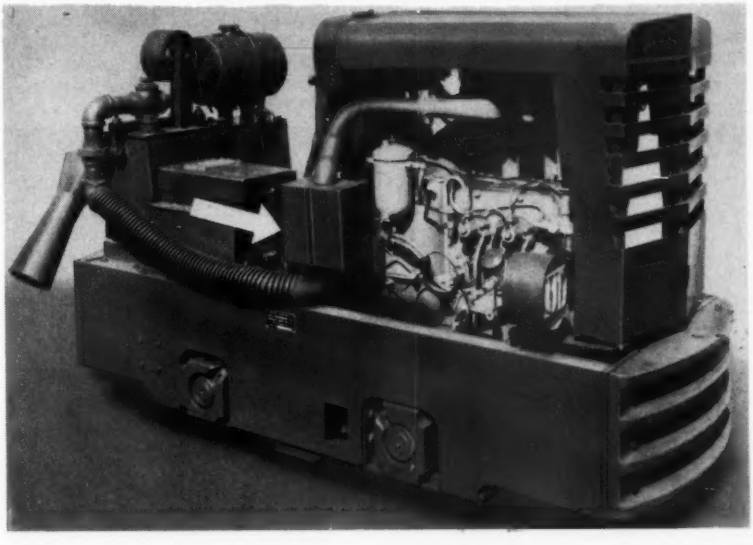
Additional information may be obtained from Bush Engineering & Manufacturing Co., No. 5 Lester Court, Salt Lake City 1, Utah.

Small Diesel Locomotive

A 1½-TON UNDERGROUND diesel locomotive for mining and tunnel work, with fumes from its engine exhaust removed by a catalytic purifier, has been introduced by the Hack Engineering Co. of Denver, Colo., as part of its line of Universal diesel locomotives.

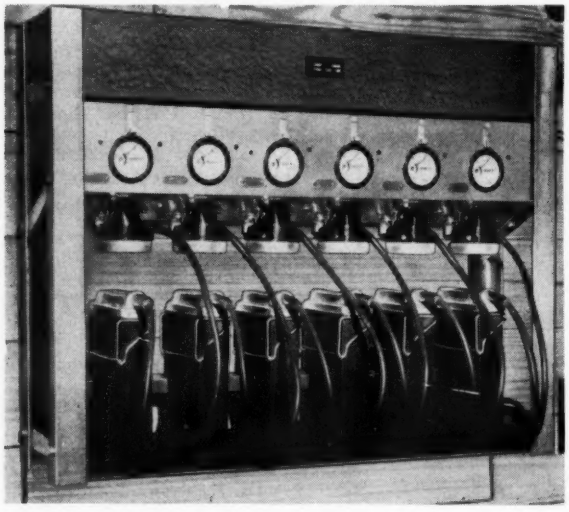
The catalytic purifier, known as the Dieseler, is made by Oxy-Catalyst, Inc., of Wayne, Pa. Oxy-Catalyst introduced the Dieseler in 1954 as a means of reducing noxious and irritating exhaust fumes of four-cycle diesel engines.

A hydraulic driven unit, the Universal locomotive is said to develop gradual power, important in picking up train loads. It is powered with a Deutz diesel engine of 18 hp and has a draw bar pull rated at 650-700 lb. The locomotive generates equal speed and power in both directions.



Six-Lamp Charger

FLEXIBLE TAPER CHARGING, said to be previously available only for installations of 50 or more lamps, is provided by the Wheat six-lamp charger. From one to six lamps may be charged simultaneously with the unit. Lamps which have been in use for one or two hours may be charged with others that have been in use for eight to ten hours. All, according to the manufacturer, will get a satisfactory charge without any setting of timers, rheostats or other adjustments. Lamps reportedly may be left on charge for extended periods without damage or excessive water loss.



Charging is controlled by a saturable reactor which allows passage of high charging currents into a discharged battery but gradually restricts, or tapers, the charging current as the battery nears full charge.

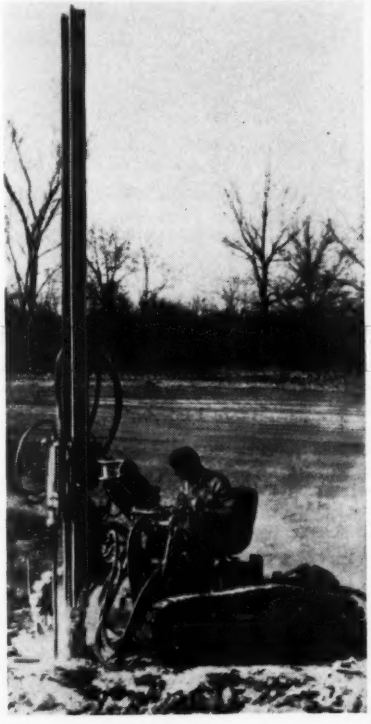
Additional information may be obtained from National Mine Service Co., 564 Alcoa Bldg., Pittsburgh, Pa.

Rock Dust Distributor

ADAPTABLE FOR WET OR DRY rock dusting, the M-S-A Bantam 400 Rock Dust Distributor is now available with a self-propelling device. The unit has a single level drive control and a tram speed of 1½ mph with a deck load capacity of 800 lb. It is reportedly designed for one man operation. The self-propelling device is available for adaption to any Bantam 400 now in service. For additional information, write for Bulletin Number 1201-5, Mine Safety Appliances Co., 201 North Braddock Ave., Pittsburgh 8, Pa.

Drill Unit

A DELUXE MODEL Air Trac has been announced by the Gardner-Denver Co., Quincy, Ill. This model has been designed to provide complete power positioning of all vertical, horizontal and flat lifter holes. The hydraulic drill positioner, Model



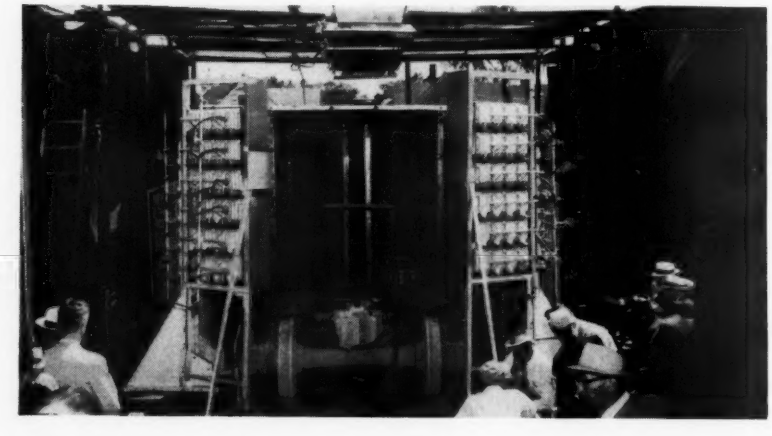
DPAT, is said to provide 120° mast swing and can be indexed for an additional 90° swing. It provides 90° dump and can be indexed for a full 360° dump. Twin hydraulic cylinders provide a T-bar left of 86° 30', which will bring the T-bar from below horizontal to nearly vertical.

The manufacturer reports that all controls on the deluxe Air Trac, for mast positioning, crawler drive and drilling, have been centralized on a single remote-control panel. This allows fingertop control of all operations.

Thaws Iron Ore Freight Cars

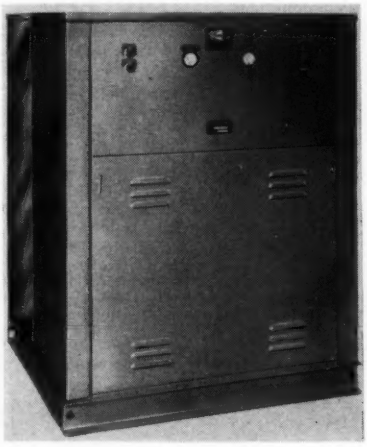
A HEATING METHOD, reportedly capable of thawing a rail car filled with frozen iron ore in minutes, was recently demonstrated by Perfection Industries, Division of Hupp Corp., 1135 Ivanhoe Road, Cleveland 10, Ohio.

According to Perfection, the method, which utilizes infra-red rays produced by a gas infra-red generator, will facilitate winter shipping of ores and coal in the northern part of the United States and Canada by reducing the costs of thawing and handling.



Chemical Proportioner

REQUIRING ONLY WATER SUPPLY, pump discharge and electrical connections, a chemical proportioner has been developed by the Johnson-March Corp., Philadelphia 3, Pa., to proportion its surface active wetting

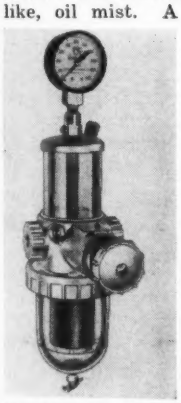


compound with water automatically and pump the mixed solution at variable rates of flow.

The unit, known as the Type S liquid proportioner, is used with the latest of the company's Chem-Jet liquid dust control systems. Pump, motor and proportioner are now incorporated inside one housing to save space and protect equipment from the weather and physical damage.

Air Control Device

A COMPLETE PACKAGE UNIT or compressed air operations, it regulates to desired pressure, filters water and dirt from the air line and lubricates the air stream with a fine fog-like, oil mist. A three-in-one combination Regulator-Filter-Lubricator that performs three important operations simultaneously, the device is ready to install and requires two connections. It is available in ¼, ⅜, ½ and ¾ in. pipe sizes.



Brochure No. 80 describes this unit and other PSC Air Control devices. Write to Perfecting Service Co., 332 Atando Ave., Charlotte 6, N. C.

— *Announcements* —

Appointment of **E. F. Murphy, Jr.**, to the position of assistant sales manager of **Anaconda Sales Co.** was recently announced. Murphy will be in charge of aluminum sales, a newly-created post, according to T. A. Campbell, president. He joined the company in 1949 at its Boston office and has been a sales engineer for the Anaconda Wire & Cable Co. at its Washington, D. C., office since 1952.

Wayne Burnside has been appointed sales manager of **Brunner & Lay, Inc.** Formerly sales manager of Brunner & Lay Rock Bit of Philadelphia, Pa., he comes to Franklin Park with extensive experience in sales and service of pneumatic accessory tools and carbide drill bits.

B. H. Puerner has been named manager of special projects for **Allis-Chalmers International,** new operating division recently formed by **Allis-Chalmers.** Puerner had been assistant manager of the processing machinery department since 1951. Before that he held various positions in the department, including manager of the crushing, cement and mining machinery section, and chief application engineer for pyro-processing machinery.

Clessie L. Cummins has retired as honorary chairman of the Board and as a director of **Cummins Engine Co., Inc.,** Columbus, Ind., according to an announcement by Irwin Miller, chairman of the Board.

Cummins, now 68, founded the company which bears his name in 1919 and was its president from 1919 to 1947. He served as chairman of the Board from 1947-1951 and as honorary chairman of the Board since that date. He has been a director of the company since its founding. In 1943, during World War II, he was director of Diesel Production, War Production Board.

Known as the father of the high-speed diesel engine in America, he will devote his full time in the future to Centco, a research company which he has organized at Sausalito, Calif.

Joel Hunter, president of **Crucible Steel Co. of America,** has announced the company's establishment of a new Applied Research Laboratory to be located at Crucible's Sanderson-Halcomb Works in Syracuse, N. Y. He also announced appointment of **Dr. A. M. Aksoy** as manager of the new laboratory. Dr. Aksoy has been chief metallurgist for Vacuum Metals Corp., Syracuse, an operating division of Sanderson-Halcomb Works.

CATALOGS & BULLETINS

CAR SHAKER. *Allis-Chalmers Mfg. Co., Milwaukee 1, Wis.* Features of the Allis-Chalmers car shaker are described in Bulletin No. 07B7221B. Said to be designed for safe, fast and economical pushbutton unloading of granular material from open, hopper-bottom gondola cars, the car shaker has high lift bars with conveniently spaced holes which facilitate centering on car eaves and reportedly make easy the attaching of hooks or shackles of any hoist.

SERVING THE COAL INDUSTRY. *Heyl & Patterson, Inc., 55 Fort Pitt Boulevard, Pittsburgh 22, Pa.* Available to any mine personnel interested in coal preparation and water clarification, Brochure 557-CP describes some of the recent facilities built by Heyl & Patterson for the coal mining industry.

TOOL CATALOG. *Weatherhead Co., Customer Service Department, 128 West Washington Blvd., Fort Wayne, Ind.* Identified as Catalog 6111, it features the line of tube working tools which Weatherhead has added to its line of brass and steel tube fittings, hydraulic hose, hose ends and assemblies. The catalog illustrates and describes tools for flaring, burnishing, double flaring, cutting, bending and joining copper and J.I.C. steel tubing. Complete instructions and specifications are included for each.

PNEUMATIC GRAPPLE. *Joy Manufacturing Co., Oliver Bldg., Pittsburgh 22, Pa.* The Joy JPG-200 Pneumatic Grapple for shaft mucking is the subject of bulletin 4-3. Details are given on operation and application of the Grapple, which is said to be adaptable to most types of shafts—including inclined, multiple compartment and blind or offset. Consisting essentially of six orange-peel-like tines that are actuated by a pneumatic cylinder, the unit has a capacity of 0.4 cu yd. Loading rate is estimated at 25 tph at nominal depths. Also included is a description of the Joy AF-111 single air drum hoist which serves to raise and lower the Grapple in its loading cycle.

BRASS HOSE FITTINGS. *Le-Hi Division, Hose Accessories Co., 2704 No. 17th Street, Philadelphia 32, Pa.* Bulletin No. 140 describes and illustrates Le-Hi brass hose fittings for low and medium pressure service in conveying air, spray, steam, suction, water, welding, etc.

LIQUID CHEMICAL FEEDER. *The Clarkson Co., 564 Market St., San Francisco, Calif.* Bulletin No. 575 features the Clarkson Feeder Model E in 18-8 stainless steel for controlled feeding of liquids.

SAFETY EQUIPMENT. *General Scientific Equipment Co., 7516 Limekiln Pike, Philadelphia 50, Pa.* Catalog 10 presents the company's entire line of safety equipment. It includes all types of protective equipment—from a small half-ounce dust mask to a large barrel lifter—with nearly all of the several hundred listed items illustrated. General specifications and recommended uses are given for each.

COMPRESSORS. *Davey Compressor Co., Kent, Ohio.* Bulletin E-268 shows component parts of the Davey Hydrovane Rotary Compressors. Among features stressed is accessibility for inspection or repair.

(Continued on page 100)

(Continued from page 99)

CENTRIFUGAL PUMPS. *Allen-Sherman-Hoff Pump Co., 259 East Lancaster Ave., Wynnewood, Pa.* Technical Data Brochure No. 357 replaces tables of figures with nomographs and charts as easier aids in selecting the proper types and sizes of pumps. It includes outline dimensions of Hydroseal, Centriseal and Packless rubber-lined pumps, Hydroseal Metal pumps and Hydroseal Vertical Sump pumps. The brochure also gives advice on proper construction of sump chambers.

MOTION PICTURES. *Pittsburgh Film Distribution Center, United States Steel Advertising Division, 525 William Penn Place, Pittsburgh 30, Pa.* This (19th edition) catalog describes educational and entertaining motion pictures sponsored and distributed by United States Steel.

GEARED FLEXIBLE COUPLINGS. *Link-Belt Co., Dept. PR, Prudential Plaza, Chicago 1, Ill.* Book No. 2775 details pertinent application and selection data for couplings with maximum bores ranging up to seven in. and ratings from 2½ to 572 hp per 100 rpm.

PRODUCT RESEARCH AND DEVELOPMENT. *Information Services Dept., Franklin Institute Laboratories, 20th and Parkway, Philadelphia 3, Pa.* Booklet describes services offered by the Laboratories in this field. Under the headings "Product Planning and Design," "Materials," "Production," and "Processes," the 20-page brochure lists specific areas in which the Laboratories is staffed and equipped to perform research and development. Projects already completed, or underway, are mentioned to illustrate the extent of Laboratories services. Copies of the booklet are available without charge to those who write, on company letterhead.

CONVEYOR BELT. *Boston Woven Hose & Rubber Co., P. O. Box 1071, Boston 3, Mass.* This revised folder gives up-to-date information and specifications on the company's complete line of Boston High Tension Belts.

HEAVY MEDIA EQUIPMENT. *Mining & Milling Machinery Division, Ore & Chemical Corp., 80 Broad St., New York 4, N. Y.* This bulletin describes the OCC vessel for heavy-media separation. Five basic models are available, which range in capacity up to 400 tph.

WIRE ROPE. *Wire Rope Divisions, American Chain & Cable Co., Inc., Wilkes-Barre, Pa.* Bulletin DH-91 describes ACCO Signalkore Wire Rope. According to the manufacturer, this wire rope not only transmits force, but it also transmits electrical energy for carrying of continuous communication instructions. This was made possible by development of a method by which copper wire conductors are imbedded in a fiber center, which is then "laid up" is a regular steel wire rope.

ABRASION. *Leschen Wire Rope Division, H. K. Porter Co., Inc., 2727 Hamilton Ave., St. Louis 12, Mo.* Bulletin No. 101 describes the principal causes of abrasion and lists numerous suggestions for minimizing its effects.

MODERN MINING. *Advertising Division, Caterpillar Tractor Co., Peoria, Ill.* A catalog of modern, heavy-duty machinery in today's mine, Form No. 32554 shows how the crawlers, wheel tractors, tractor-shovels and motor graders manufactured by Caterpillar help increase production in many ways.

ORIENTED DIAMOND DRILL BITS. *Hoffman Bros. Drilling Co., Punxsutawney, Pa.* Said to be designed for quick, easy location of important drill bit data, Hoffman's catalogue lists sizes, setting charges, weights, uses, etc., for all standard bits. Price sheets are being distributed along with the catalogues.

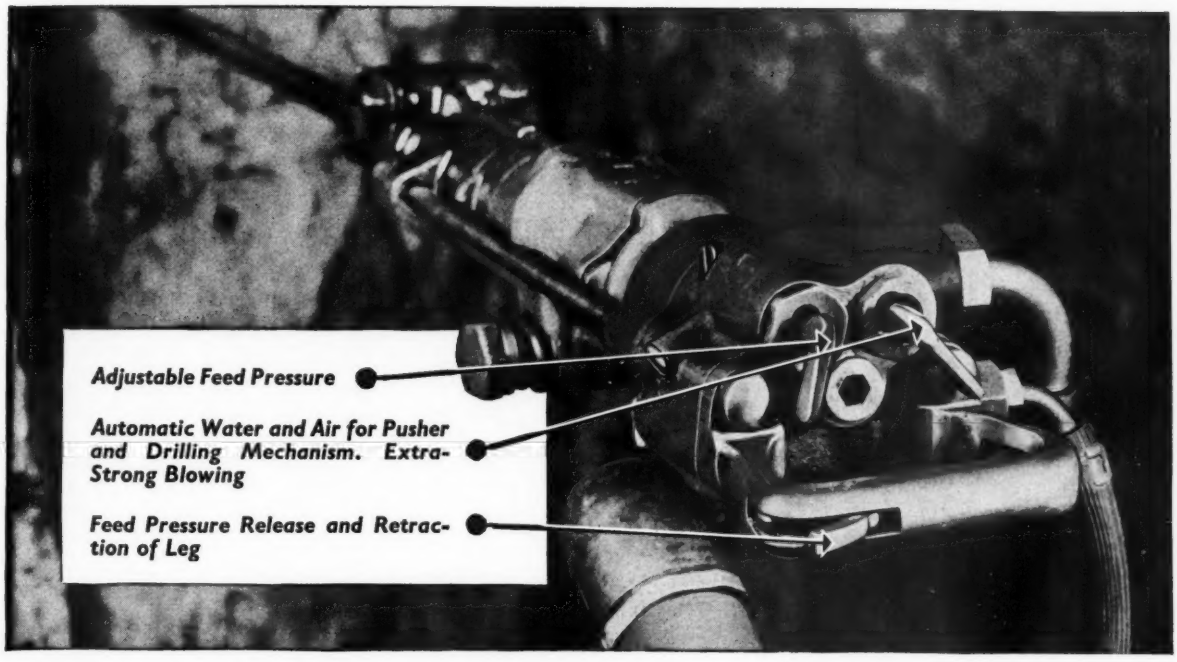
STATIONARY AIR COMPRESSORS. *Sales Promotion Dept., Le Roi Division, Westinghouse Air Brake Co., Milwaukee, Wis.* Three pieces of literature describing the entire line of Westinghouse unit type and Le Roi stationary air compressors have been issued. The compressors described range in size from ½ to 100 hp and include both single and two-stage units.

FITTINGS FOR MEDIUM PRESSURE HOSE. *W. D. Wynant, Tube & Hose Fittings Division, Parker Appliance Co., 17325 Euclid Ave., Cleveland 12, Ohio.* Rubber covered single wire braid hose and reusable Hoze-lok fittings which do not require the hose cover to be skived off are described in Parker catalog 4434.

PUMPING UNITS. *Sprague & Henwood, Inc., 221 W. Olive St., Scranton 2, Pa.* Bulletin No. 370 illustrates, describes and gives specifications on pumping units for soil sampling, core drilling and pressure grouting. The units are available with any one of four types of power units and several types of drive assembly.

BATTERY USERS MANUAL. *Gould-National Batteries, Inc., Trenton 7, N. J.* Covering the complete scope of motive-power battery maintenance and repair, this 44-page book has been specifically designed to enable plant engineers, superintendents and foremen to conduct an organized battery training course in their own plant. The reference manual includes over 60 photographs, diagrams and tables to review battery theory and construction, demonstrate proper battery selection, illustrate charging method and equipment, demonstrate battery testing and technique, and to present correct battery room layout.

Index to Advertisers



THE ATLAS COPCO LION— A REVOLUTIONARY NEW ROCK DRILL

All controls under one hand

The Atlas Copco Lion is the first drill to have all the valves which operate the drill under the control of one hand. *Full and easy control without having to move the hand from the backhead!* All the controls have been designed so that they are well protected. While using them the operator's hand is never near the wall or roof of the drift. The Lion is the first pusher leg drill with controls placed for drifting.

Retractable leg saves time

When the leg has to be moved the feed pressure is easily released by squeezing the hand grip. By further pressure on the grip the leg retracts automatically. When the leg is in the new position suitable for continuous drilling, retraction stops and the feed pressure comes back by loosening the grip of the hand. *All this can be done while the drill is still running.*

This new idea of a retractable leg enables quicker repositioning of the leg and reduces the number of steel changes, thereby increasing footage per manshift. When drilling high holes it is now far easier to alter the position of the leg more frequently in order to maintain an optimal feed angle and feed pressure.

Packed with power for deep holes

The Lion has a drilling rate at least 30% higher than other rock drills of the same weight. Furthermore, it can maintain its high speed *even when drilling deep holes.* This means quickly drilled deep hole rounds and a faster advance. The Lion also reduces *to a minimum* the gauge wear of the bits in abrasive rock. And owing to the ease with which the feed pressure is released and brought back into action, the Lion is a *handier* drill to work with in fissured rock.

Sandvik Coromant—the steel for the Lion

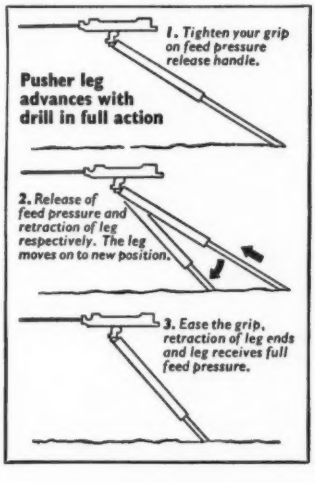
All Atlas Copco drills—and this goes for the Lion too—have been developed from the earliest stages with Sandvik Coromant tungsten-carbide-tipped integral steels and detachable bits. This combination pioneered tungsten carbide drilling in the early forties. No drill or steel developed separately could ever give such equivalently high performances as this drilling combination. Today it is the most widely used in the world, responsible for drilling more than 1,000 million feet annually.

For further information on the Atlas Copco Lion rock drill, and details of sales and service, please contact:

U.S.—Atlas Copco Pacific, Inc., 930 Brittan Avenue, San Carlos, California, or Atlas Copco Eastern Inc., P.O. Box 2568, Paterson 25, N.J.

CANADA—Atlas Copco Canada Limited, Montreal Airport, P.Q.

MEXICO—Atlas Copco Mexicana S.A., Apartado Postal 56, Torreon, Coahuila.



Atlas Copco

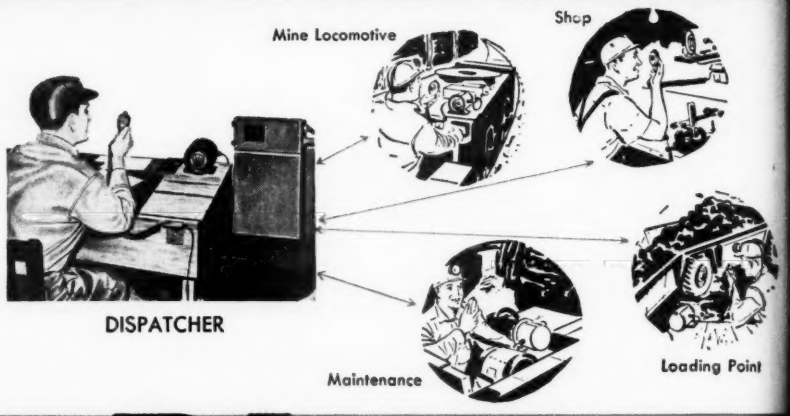
D5574A

Manufacturers of Stationary and Portable Compressors, Rock-Drilling Equipment, Loaders, Pneumatic Tools and Paint-Spraying Equipment

Increase Your Production and Mine Safety with these M·S·A Communication Systems

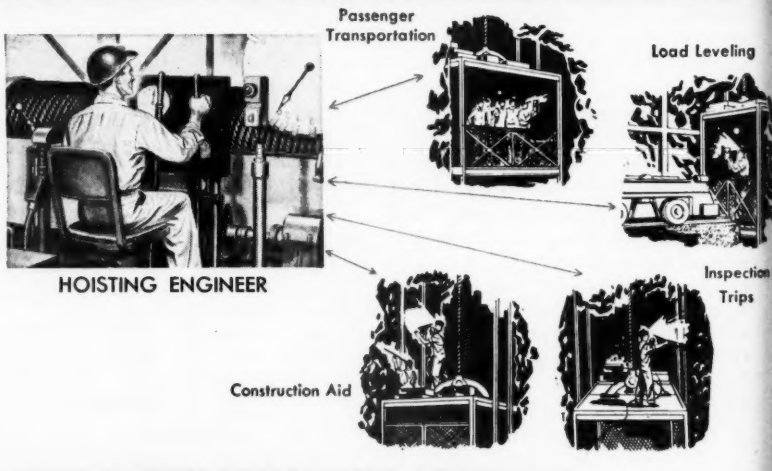
MinePhone

The M.S.A. MinePhone is eliminating communication delays in many modern mines everywhere. This clear, instant two-way voice communication system coordinates the wide variety of operations vital to peak production. Haulage moves faster because dispatcher and motormen are constantly in touch, even while trips are in motion. Shop and maintenance personnel are always "on call" to keep mining equipment in operation. Because messages are relayed instantly, on an open-line hook up, the MinePhone brings an added measure of safety to all operations. Write for details.



HoistPhone

The M.S.A. HoistPhone provides continuous, dependable and efficient voice communication between hoisting engineer and cage, at any level, and when in motion. The system is invaluable in emergencies, yet designed for day-in-day-out service. Ideal for passenger travel, load leveling, inspection trips, and construction work, the HoistPhone requires no special training; utilizes existing wiring. Write for complete details.



MSA
SAFETY EQUIPMENT HEADQUARTERS

When you have a safety problem, M.S.A. is at your service. Our job is to help you.

MINE SAFETY APPLIANCES COMPANY
201 North Braddock Avenue, Pittsburgh 8, Pa.
At your service: 77 branch offices in the United States and Mexico

MINE SAFETY APPLIANCES CO. OF CANADA, LTD.
Toronto, Montreal, Calgary, Edmonton, Winnipeg, Vancouver, Sydney, N.S.

ing Point

Leveling

Inspection
Trips